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# USSR Report

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BIOMEDICAL AND BEHAVIORAL SCIENCES

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USSR REPORT  
LIFE SCIENCES  
BIOMEDICAL AND BEHAVIORAL SCIENCES

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NITROGEN'S BIOLOGICAL EFFECT ON OXYGEN TRANSPORT THROUGH  
HEMATOPARENCHYMAL BARRIER

Kiev FIZIOLOGICHESKIY ZHURNAL in Russian Vol 31, No. 6, Nov-Dec 85  
(manuscript received 6 Jul 84) pp 641-645

[Article by V. A. Berezovskiy and V. I. Nosar, Institute of Physiology  
imeni A. A. Bogomolets, UkSSR Academy of Sciences, Kiev]

[Text] Normal human and animal respiration takes place in a gas medium (air) consisting of 78% nitrogen and 21% oxygen under a total pressure of 1,013 gPa (760 mm Hg). Under special conditions, frequent use is made of nitrogen-free gas mixtures such as helium-oxygen mixtures. This is based on the supposition that inert gases are also biologically inert. However, studies undertaken in recent decades have shown that inert gases do have a number of biological effects and are therefore not neutral with respect to the organism [1, 3, 13]. Gas mixtures containing helium, argon, neon, and other inert gases induce changes in expiration, hemodynamics, and tissue respiration [2, 8, 10, 11].

The purpose of the present work is to study the effect of a nitrogen-free gas mixture on oxygen tension in arterial blood and tissues, local circulation, and oxygen mass transfer through the hematoparenchymal barrier (HPB) at low oxygen partial pressure ( $P_{O_2}$ ) and at normal atmospheric pressure.

Method

The studies were conducted on 23 Chinchilla male rabbits weighing 2.0 -- 2.5 kg under a local 2% novocaine local anesthesia. The air and gas mixtures were fed through a mask fitted with inhalation and exhalation valves. After allowing the animals to breathe air, they were switched to inspiration of a 7.4%  $O_2$  -- 92.6% N mixture for 20 minutes. They were then given a helium-oxygen mixture consisting of 7.4%  $O_2$  and 92.6% helium. In part of the experiments the gas mixtures were supplied in reverse order. Throughout the entire experiment oxygen tension was recorded in lower extremity arterial blood ( $P_aO_2$ ) and in the same extremity's venous blood ( $P_vO_2$ ). Also recorded were the pH of arterial and venous blood, hemoglobin concentration, local circulation rate with respect to hydrogen clearance ( $Q_M$ ), and oxygen tension in the gastrocnemius muscle ( $P_mO_2$ ). Oxygen partial pressure was measured polarographically on aged open electrodes



calibrated in two standard solutions. Blood  $P_{O_2}$  was measured with a covered electrode by measuring diffusion current on a LP-7 polarograph. Hemoglobin concentration (Hb) was measured with a FEK-M photoelectrocolorimeter by the hemoglobin-cyanide method, and blood hydrogen ion concentration was determined by an OP-212 instrument. Blood oxygen saturation ( $Sa_{O_2}$ ,  $Sv_{O_2}$ ), and tissue oxygen consumption ( $V_{O_2}$ ) were calculated on the basis of the enumerated indices and the oxyhemoglobin dissociation curve of a rabbit that accounts for the Bohr effect [7].

The diffusion capacity of the hematoparenchymal barrier for oxygen was calculated by the formula we devised:  $DC_{HPBO_2} = \frac{3 \cdot [(1,34 \cdot 10^{-4} \cdot Q_M \cdot Hb (S_{aO_2} - S_{vO_2}))]}{P_{aO_2} + 2P_{vO_2} - 3P_{MO_2}}$ .

The data were statistically processed.

## Results and Discussion

After the rabbits were put on inspiration of hypoxic gas mixtures, there was a reduction in arterial blood oxygen tension and Hb oxygen saturation in all of the animals. That reduction was more pronounced in the presence of helium (see Table). Oxygen tension in venous blood was also lowered both by nitrogen and helium. However, no statistically reliable differences were detected in the reduction of these indices in relation to the oxygen-attendant gas (see Table). The reduction in the variance of oxygen in the arterial and venous blood was particularly pronounced when the animals breathed the hypoxic helium-oxygen mixture in which case the pH of the venous blood dropped regardless of the accompanying gas whereas the pH of arterial blood and Hb concentration did not change. There was a significant difference in the oxygen partial pressure in skeletal muscle when the animals were breathing the hypoxic nitrogen-oxygen and helium-oxygen mixtures. These differences were particularly pronounced for 15 -- 20 minutes (Diagram 1). Thus, when the animals breathed the nitrogen-oxygen mixture,  $P_{MO_2}$  decreased from  $31.9 \pm 5.2$  gPa ( $24.0 \pm 3.9$  mm Hg) to  $21.4 \pm 3.6$  gPa ( $16.1 \pm 2.7$  mm Hg), and when they breathed the helium-oxygen mixture, the  $P_M$  decreased to  $15.4 \pm 2.0$  gPa ( $11.6 \pm 1.5$  mmHg) (Diagram 2). The arterial-tissue gradient for oxygen for reliably higher during the inspiration of the hypoxic nitrogen-oxygen gas mixture which contributed to a greater oxygen transfer from the blood to the tissue (see Table).

We undertook a study of the changes in blood flow volume rate in muscle and oxygen consumption in skeletal muscle in order to find the reasons for the different degrees of  $P_{MO_2}$  reduction. We found that the blood flow rate in muscle decreased by 24% when the animals were switched from air to nitrogen-oxygen inspiration, and it decreased by 46% in helium-oxygen inspiration (Diagram 2). Analogous results were obtained in rat mesentery with the aid of television microscopy in an experiment where the animals were fed helium-oxygen gas mixtures with 9.5%  $O_2$  [6].

Skeletal muscle oxygen consumption also decreased markedly during the inspiration of a hypoxic helium-oxygen gas mixture (Diagram 2). The differences of these indices were on the boundary of reliability. Reliable

differences in the degree of gas exchange reduction in rats during the inspiration of nitrogen- and helium-oxygen mixtures with 7.4 %  $O_2$  have been observed [10]. Calculations of the diffusion capacity of the hematoparenchymal barrier for oxygen have shown that the barrier's permeability increased by 17% during the inspiration of a hypoxic helium-oxygen gas mixture, and increased by 33% (Diagram 2) during the inspiration of a hypoxic nitrogen-oxygen mixture.

Table 1. Several Blood Index Changes During Rabbit Inspiration of Various Gas Mixtures

(1) Газовые смеси	$P_{aO_2}$	p	$P_{vO_2}$	p	$P_{(a-v)O_2}$	p	$S_{aO_2}$	p	$S_{vO_2}$	p	$\Delta P_{(a-v)O_2}$	p	$pl_{\dot{V}_O_2}$	p
21 % $O_2$ + 79 % $N_2$ (2) гПа (3) мм рт. ст. (n=23)	113.4±2.46 85.3±1.85		49.3±1.09 37.1±0.82		64.1±2.44 48.2±1.84		121.0±0.82 91.0±0.62		71.5±2.0 53.8±1.51		81.5±3.23 61.3±2.43		7.32±0.013	
7.4 % $O_2$ + +92.6 % $N_2$ гПа мм рт. ст. (n=23)	58.65±2.38 44.1±1.79	<0.01	31.5±2.23 23.7±1.68	<0.01	27.1±2.31 20.04±1.74	<0.01	87.8±2.79 66.0±2.10	<0.01	35.9±3.74 27.0±2.81	<0.01	37.2±1.61 28.0±1.21	<0.01	7.30±0.012	>0.05
7.4 % $O_2$ + +92.6 % He гПа мм рт. ст. (n=23)	49.34±2.15 37.1±1.61	<0.01	29.3±1.93 22.0±1.45	>0.05	20.1±1.61 15.1±1.21	<0.01	79.8±1.49 60.0±1.12	<0.01	33.2±4.12 25.0±3.10	>0.05	33.9±1.24 25.5±0.93	<0.05	7.29±0.014	>0.05

Key: 1. Gas mixtures  
2. gPa  
3. mm Hg

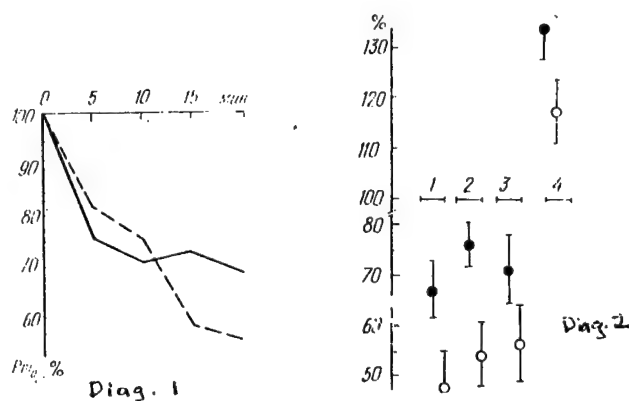


Diagram 1. Dynamics of Oxygen Tension Change in Rabbit Skeletal Muscle ( $P_{mO_2}$ ) during the Inspiration of Hypoxic Nitrogen- and Helium-Oxygen Mixtures.

Vertical axis --  $P_{mO_2}$ , %; Horizontal axis -- time, in minutes.  
 Continuous line -- nitrogen-oxygen mixture; Broken line -- helium-oxygen mixture.

Diagram 2. Oxygen Tension Change in Skeletal Muscle --  $P_{mO_2}$  (1) volume blood flow rate in muscle --  $Q_M$  (2), skeletal muscle oxygen consumption --  $V_{O_2}$  (3), diffusion capacity of skeletal muscle hematoparenchymal barrier for oxygen --  $DC_{HPBO_2}$  (4) in % in rabbits per 20 minute period of breathing hypoxic nitrogen- and helium-oxygen gas mixtures. Black circles -- nitrogen-oxygen mixture; white circles -- helium-oxygen mixture.

Thus, the reliable differences in the series of values obtained in our experiments indicate that oxygen mass transfer across the HPB is worse during the inspiration of an hypoxic helium-oxygen gas mixture with low oxygen partial pressure (7.4%) than it is in the case of an hypoxic nitrogen-oxygen mixture [12]. That data also indicated that hypoxia developed much earlier when the rabbits were breathing the helium-oxygen mixture at a pressure of 1.02 kg/cm<sup>2</sup> than it did during the inspiration of the nitrogen-oxygen mixture. The author indicates that helium specifically intensifies hypoxia in the animals. It has been established [15] that many more rye seeds perish in a helium medium than in a nitrogen medium. Information on the biophysical mechanisms underlying helium's effect on physiological processes is extremely limited. It has been noted that helium alters the biophysical properties of cellular plasma membranes and permeability to oxygen [14, 16]. Inasmuch as cell membranes are an essential component of the HPB, the observed changes in its diffusion capacity may be due to the action of helium on the membrane structures. At the same time, those effects might be due both to the action of helium and the deprivation of the tissues' normally available nitrogen. The role of tissue nitrogen starvation in this mechanism is a question that has not been sufficiently studied. It has been found that the lack of nitrogen in liver homogenates incubated under elevated oxygen tension conditions leads to a more abrupt intensification of tissue respiration [8] which the authors believe is indicative of nitrogen's destabilizing action on biological oxidation. Nitrogen's narcotic action under elevated pressure is well known [4, 5, 9]. It can be assumed that nitrogen's biological action can also be affected at a lower  $P_{O_2}$ . This is confirmed by the data we obtained that show that tissue oxygen consumption increases in a normal oxygen helium-oxygen mixture. The increased blood flow under these conditions might be a secondary manifestation of oxidative metabolism activation, although one should not exclude the direct effect of nitrogen absence on the cellular elements of the vascular wall. The administration of a helium-oxygen mixture at normal oxygen pressure turned out to be the most effective [2]. In this case, oxygen tension in arterial blood and tissue blood flow increased, and the hemodynamic equivalent decreased, i.e., the intake, transport, and utilization of oxygen in the organism improves.

No reliable differences in oxygen mass transfer across the HPB in relation to the accompanying gas were detected during the inspiration of hypoxic nitrogen- and helium-oxygen mixtures with a  $P_{O_2}$  of 11% [2]. The reason for such a discrepancy in the effect that gas mixtures containing 7.4 and 11%  $O_2$  have, is not clear. It follows from the cited data that the biological action that nitrogen and helium exert on oxygen transfer across the HPB depends on their content in the gas media.

The more pronounced reduction in skeletal muscle oxygen tension during the inspiration of an hypoxic helium-oxygen mixture was due to the marked drop of arterial blood oxygen tension, muscle blood flow reduction, and an insignificant increase in the HPB's permeability to oxygen as compared to these index changes during the inspiration of an hypoxic nitrogen-oxygen mixture at the same oxygen partial pressure. In other words, it has been shown that hypoxia in animals is exacerbated by high concentrations of helium.

### Conclusions

1. The presence of nitrogen in an hypoxic gas mixture (7.4%  $O_2$ ) enhances an increase in the diffusion capacity of the hematoparenchymal barrier for oxygen.
2. Animal inspiration of an hypoxic nitrogen-oxygen gas mixture results in a less marked reduction of arterial blood oxygen tension than the inspiration of a helium-oxygen mixture at the same oxygen partial pressure.
3. The reduction in skeletal muscle oxygen tension and muscle blood flow is also less pronounced during the inspiration of an hypoxic nitrogen-oxygen gas mixture.

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6289

CSO: 1840/240

UDC 57.034:612.172+612.216

DESYNCHRONIZATION OF HEART RATE AND BREATHING FREQUENCY AFTER TRANSMERIDIONAL FLIGHT ACROSS THREE TIME ZONES

Moscow FIZIOLOGIYA CHELOVEKA in Russian Vol 11, No 6, Nov-Dec 85 (manuscript received 12 Sep 83) pp 915-922

[Article by A.A. Putilov, Institute of Physiology, Siberian Department, USSR Academy of Medical Sciences, Novosibirsk]

[Abstract] A group of six male scientists (26-36 years) performed a self-study to assess changes in the relationship of the heart rate to that of the respiratory rate after a flight across three time zones (Novosibirsk-Vladivostok). The observations revealed that 2-3 days after the flight signs of intra- and interparametric desynchronization of circadian and ultradian rhythms appeared. The degree of desynchronization increased in the 2-4 day interval, with persistence for ca. 10 days. A similar phenomenon was noted in the deviation (in %) of the heart rate:respiratory rate whole number ratio. The latter parameter remained elevated for ca. 1.5 weeks. Flight across one time zone (Novosibirsk-Irkutsk) was not accompanied by similar sequelae. These observations suggest an intimate relationship between resonance phenomena of the different chronostructures operating at different frequency bands. Assessment of the heart and respiratory rates was thus shown to offer a convenient method for studying adaptation and cardiopulmonary desynchronization. References 22: 16 Russian, 6 Western.

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CSO: 1840/244

UDC 612.117+014.462

CHANGES IN BLOOD CONDUCTIVITY DURING IMMERSION

Moscow FIZIOLOGIYA CHELOVEKA in Russian Vol 11, No 6, Nov-Dec 85 (manuscript received 7 Apr 84) pp 1028-1030

[Article by V.G. Kozlova and Ye.A. Aleksandrova, Moscow]

[Abstract] Determinations were made of specific electrical resistance of blood to assess the information obtained in this manner as an indicator of the

level of hydration. The studies on the effects of water immersion on blood conductivity were carried out on 12 healthy men, 25-35 years of age. Baseline values of blood resistance ranged from 180 to 230 ohm·cm. Within 6-10 h of immersion, blood resistance increased by 18-20%, reaching maximum values of over 240 ohm·cm by day 7. After immersion blood resistance returned rapidly to baseline values. The changes in resistance were correlated with plasma electrolytes and degree of hydration, demonstrating the utility of measuring blood resistance as an indicator of hydration. Figures 1; tables 1; references 10: 8 Russian, 2 Western

12172/13046  
CSO: 1840/244

#### EFFECT OF WEAK ULTRA-LOW-FREQUENCY VARIABLE MAGNETIC FIELD ON DEVELOPMENT OF HYPERCOAGULATION SYNDROME IN RATS DURING HYPODYNAMIA

Moscow BIOFIZIKA in Russian Vol 30, No 6, Nov-Dec 85 (manuscript received 20 Aug 84; revised manuscript received 4 Jan 85) pp 1046-1049

[Article by N.A. Temuryants and A.V. Mikhaylov, Simferopol State University imeni M.V. Frunze]

[Abstract] White, male, mongrel rats (180-200 g) were placed in one of four groups. Group 1 rats were kept in 14x6x55 cm cages. Group 2 rats were subjected to hypokinesia and a superhigh frequency variable magnetic field. Group 3 rats were kept in an ordinary vivarium and subjected to a superhigh frequency magnetic field and group 4 rats with normal motor activity made up a control group. Groups 2 and 3 were exposed to a variable magnetic field of 8 Hz frequency and 4 A/m voltage. The state of the blood coagulation system was checked on the 1, 3, 5, 9, 21 and 45th day of hypodynamia immediately after a 3-hour exposure to the magnetic field. Multiple daily exposure to the magnetic field caused a hypocoagulation shift of the blood in groups 1 and 4. The combined effect of the magnetic field and hypokinesia corrected the hypercoagulation shift which developed in the restrained rats. Prolonged exposure to the magnetic field created the greatest effect on the rats. The experiment confirmed the limitation of development of hypercoagulation of the blood of rats subjected to hypokinesia under conditions of the experiment. References: 11 Russian.

2791/13046  
CSO: 1840/220



EFFECTS OF STEM RUST INFECTION ON RNase ACTIVITY IN INFECTED WINTER RYE LEAVES

Minsk DOKLADY AKADEMII NAUK BSSR in Russian Vol 30, No 12, Dec 86 (manuscript received 12 Mar 86) pp 1133-1135

[Article by D.K. Ges, Z.Ya. Serova, G.I. Spiridonova and N.P. Neklesa, Institute of Experimental Botany imeni V.F. Kuprevich, Belorussian SSR Academy of Sciences]

[Abstract] To determine the effects of stem rust infection on RNase activity in infected and adjacent leaves of winter rye, the plants were infected with *Puccinia graminis* uredospores and enzymatic activity was monitored for 12 days. A bimodal response in terms of RNase activity was noted in infected and adjacent leaves, consisting of peaks of elevated activity on days 2 and 6.8. After 12 days, RNase activity fell below baseline level. The enhanced RNase activity was ascribed to the synthesis of new enzyme proteins which were less heat-stable than the RNase of uninfected control plants. The exact relationship of these changes in RNase activity to plant susceptibility to stem rust remains to be elucidated, in view of the views that elevated RNase activity signifies increased resistance. Figures 1; references 10: 3 Russian, 7 Western.

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CSO: 1840/213

UDC 547.26'118

PHOSPHORYLATION OF m,m'-DIBROMODIBENZO-18-CROWN-6 BY TRIALKYLPHOSPHITES

Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 56, No 10, Oct 86 (manuscript received 7 Feb 86) pp 2419-2420

[Article by L.N. Markovskiy, V.I. Kalchenko and L.I. Atamas, Institute of Organic Chemistry, UkSSR Academy of Sciences, Kiev]

[Abstract] A method of introducing phosphorus-containing groupings directly into benzene rings of dibenzo-18-crown-6 and production of crown-ethers with an exocyclic phosphorus-aromatic carbon bond is described and discussed. The method is based on interaction of readily available m,m'-dibromodibenzo-18-crown-6 with trialkylphosphites, catalyzed by nickel halogenides. Findings of nuclear magnetic resonance, paramagnetic resonance and infrared spectroscopy studies of the compounds obtained in the reaction were presented. Some other bromobenzocrown-ethers, phosphorylated by the same method, are described briefly. References 4: 1 Russian, 3 Western.

2791/13046  
CSO: 1840/196

UDC 591.145.2-544.088:577.354

NEUROTOXIN OF KARAKURTA AND ITS INTERACTION WITH RAT BRAIN RECEPTORS

Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol 12, No 1, Jan 86 (manuscript received 25 Jun 85) pp 71-80

[Article by Yu.A. Ushkarev and Ye.V. Grishin, Institute of Bioorganic Chemistry imeni M.M. Shemyakin, USSR Academy of Sciences, Moscow]

[Abstract] A neurotoxin of Karakurta was isolated from Central Asian black widow spider venom: *Latrodectus mactans tredecimguttatus* and its reaction with rat brain synaptosomes was investigated along with molecular characteristics of its receptors. Lethal dose of the karakurta neurotoxin is 45 µg/kg body weight of mice. It consists of 1042 aminoacid radicals, but contains no free sulfhydryl groups or carbohydrate components; isoleucin is its N-terminal component. A hypothetical mechanism of action of this neurotoxin was proposed based on its binding with receptors in the presynaptic membrane followed by

massive infusion of Ca ions through the channel formed in the membrane by this neurotoxin. The data indicate highly specific receptivity of the neurotoxin in mammalian brain, its complex interaction with presynaptic membrane in which a specific class of receptors with molecular weight of 95 kD was identified. Figures 5; references 21: 4 Russian, 17 Western.

7813/13046  
CSO: 1840/218

UDC 547.964.4.057:577.152.341\*51.042

SYNTHESIS AND STUDIES OF CONFORMATIONALLY RESTRICTED ANALOGS OF PEPTIDE  
INHIBITORS OF ANGIOTENSIN CONVERTING ENZYME

Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol 12, No 1, Jan 86 (manuscript received 20 Mar 85, after final revision 1 Jul 85) pp 59-70

[Article by M.P. Filatova, N.A. Krit, O.M. Komarova, V.N. Orekhovich, Z. Reyssmann\*, I.T. Liyepinya\*\* and G.V. Nikiforovich\*\*, Institute of Biologic and Medical Chemistry, USSR Academy of Medical Sciences, Moscow; \*F. Schiller University, Jena, GDR; \*\*Institute of Organic Synthesis, LatSSR Academy of Sciences, Riga]

[Abstract] In recent years, a number of effective antihypertensive reagents have been prepared on the basis of angiotensin converting enzyme (ACE). Inhibition of ACE leads to normalization of elevated blood pressure. In order to find effective inhibitors of ACE, biochemical processes occurring in organisms must be studied and for this purpose, an adequate model must be obtained of the ACE complex with the peptide ligand. To investigate conformation of peptide inhibitors of ACE, a number of bradykinin-potentiating peptide analogs with N-methyl-alanine or D-alanine replacing of L-proline or L-alanine were synthesized and their inhibitory activity and conformations were studied. In comparison to natural peptides, all synthetic analogs exhibited diminished ACE inhibition activity. This was considered to be the proof of an earlier hypothesis on "conformational inhibition" of such peptides. Figures 3; references 19: 6 Russian, 13 Western (2 by Russian authors).

7813/13046  
CSO: 1840/218

## PURIFICATION OF CATTLE DIARRHEA VIRUS BY ADSORPTION CHROMATOGRAPHY

Frunze IZVESTIYA AKADEMII NAUK KIRGIZSKOY SSR in Russian No 4, Jul-Aug 86  
(manuscript received 15 Apr 86) pp 47-50

[Article by M.B. Musabekova and V.M. Kolikov, Institute of Biochemistry and Biophysics, Kirghiz SSR Academy of Sciences]

[Abstract] Chromatographic studies were conducted with various modes of adsorption and elution to determine optimum conditions for the purification of cattle diarrhea virus on macroporous glass 6000-GKh (6000 Å pore diameter). The resultant findings demonstrated that the conditions of optimum adsorption were presented by 0.5 M tris-HCl buffer with 1 M NaCl, pH 7.5. Adjustment of the buffer for elution at pH 8.5 resulted in optimum desorption. The final product contained only 1.3% contaminants based on ultracentrifugation analysis. Figures 2; references 4: 3 Russian, 1 Western.

12172/13046  
CSO: 1840/214

## MOLECULAR STRUCTURE OF DIBENZOMETHYLPHOSPHONYL-14-CROWN-5 IN CRYSTALLINE AND SOLUBLE STATES

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKAYA in Russian No 9,  
Sep 86 (manuscript received 21 Jan 85) pp 2003-2007

[Article by O.A. Rayevskiy, I.O. Umarova, V.V. Tkachev, L.O. Atovmyan, A.S. Shtepanek and T.N. Kudrya, Institute of Physiologically Active Substances, Chernogolovka, and Chernogolovka Department of the Institute of Chemical Physics, USSR Academy of Sciences; Institute of Organic Chemistry, Ukrainian SSR Academy of Sciences, Kiev]

[Abstract] In order to define the structural characteristics of dibenzomethylphosphonyl-14-crown-5 (I), x-ray and dipole moment analysis were employed on the compound in the crystalline state and in solution. The resultant data are summarized in tabular form and complemented with structural ball-and-stick presentations. Two planes were defined in I, at an angle of 61.3° to one another. Bond lengths and valence angles did not show any anomalous features in comparison with related compounds. On the basis of these studies, I was regarded as an analog of dibenzo-18-crown-6 in which the CCOC fragment had been replaced by P(O)Me, resulting in a reduction in the number of atoms in the ring and increased intramolecular stress. Determinations of atom-atom potentials led to identification of molecular conformations with conformational energies of less than 10 kcal/mole. Despite its relative inefficiency as an ionophore, I has been demonstrated to an effective anti-arrhythmic agent. Replacement of the phosphoryl O atom by an S atom abolished this activity. Figures 1; references 18: 15 Russian, 3 Western.

12172/13046  
CSO: 1840/265

## CHARACTERIZATION OF PHOSPHODIESTERASE SPECIFIC FOR RNA-VPg COVALENT BOND IN ENCEPHALOMYOCARDITIS VIRUS

Moscow BIOKHIMIYA in Russian Vol 51, No 2, Feb 86 (manuscript received 5 May 85) pp 249-259

[Article by Yu.F. Drygin and Ye.Yu. Siyanova, Scientific Research Laboratory of Molecular Biology and Bioorganic Chemistry imeni A.N. Belozerskiy, Moscow State University imeni M.V. Lomonosov]

[Abstract] Studies were conducted on the isolation and description of uridilyl-polynucleotide-(5'P → O)-tyrosine phosphodiesterase obtained from mouse ascitic Krebs II carcinoma cells, capable of splitting the phosphodiester bond between RNA and the VPg protein in the encephalomyocarditis virus. The enzyme was isolated by a combination of ion-exchange and affinity chromatography from cells infected with the virus, and was established to be specific for the RNA-VPg bonds in both polio- and encephalomyocarditis viruses. The enzyme was rapidly inactivated by heating at 55°C, and lost half of its activity after storage in 50% glycerol at -20°C for a month. Exposure to EDTA led to partial inactivation of the enzyme. Chromatography on Sephadex G-250 indicated that the MW of the enzyme was on the order of 24-27 kdalton. Enzyme inhibitory substances were present in the preparations of the enzyme, rendering kinetic studies difficult. On tentative grounds, this species of phosphodiesterase may be involved in regulating the fraction of the nucleic acid participating in translation. Figures 6; references 32: 7 Russian, 25 Western.

12172/13046  
CSO: 1840/236

UDC 577.175.8

## DETECTION AND LOCALIZATION OF Sy-1 PROTEIN IN HUMAN BRAIN

Moscow BIOKHIMIYA in Russian Vol 51, No 2, Feb 86 (manuscript received 20 May 86) pp 267-272

[Article by M.V. Aksenova, G.Sh. Burbayeva and T.P. Klyushnik, Brain Institute, All-Union Scientific Research Institute of Mental Health, USSR Academy of Medical Sciences, Moscow]

[Abstract] Through the use of standard isolation techniques and affinity chromatography, the Sy-1 protein was isolated from cadaveric human brains and rat brains, confirming previous reported isolation of Sy-1 from rat brains by Gennarini et al. [J. Neuroimmunol., 4(2): 69-76, 1983]. Immunochemical analysis confirmed the presence of the Sy-1 proteins, as well as their tissue and species distinctiveness. Radioimmunoassays on various human brain formations demonstrated uneven distribution of Sy-1 ranging in concentrations from

1.2 to 30  $\mu\text{g}/\text{mg}$ , with the highest concentration detected in the medulla oblongata formations. The levels of Sy-1 in other human tissues (liver, spleen, heart, lungs, kidneys, skeletal muscles) did not exceed 1-2  $\text{ng}/\text{mg}$ . Sy-1 was not detected in the plasma or the cellular elements of the blood. Although the functional role of Sy-1 remains to be elucidated, it may possibly be related to certain impulse-conducting pathways. Figures 1; tables 1; references 12: 7 Russian, 5 Western.

12172/13046

CSO: 1840/236

## BIOPHYSICS

### EFFECT OF DIOXANE ADDITIVES ON FORMATION OF COMPACT STRUCTURES AND DOUBLE-HELIX SEGMENTS IN ISOIONIC DNA SOLUTION

Moscow BIOFIZIKA in Russian Vol 30, No 6, Nov-Dec 85 (manuscript received 5 Mar 85) pp 939-942

[Article by S.M. Filippov, V.A. Prevyshe and I.A. Kuznetsov, Moscow State University imeni M.V. Lomonosov]

[Abstract] A study of the effect of additions of a solvent with low dielectric permeability on formation of compact structures and on the relationship between quantities of single-chain and double-helix segments in an isoionic solution of DNA used an Na-salt of DNA from chick erythrocytes. An isoionic solution of  $H^+$ -DNA was produced by filtering an Na-DNA solution in distilled water through a mixed layer of ionites and 1,4 dioxane was added. Potentiometric titration showed that addition of 1,4 dioxane to the DNA solution increased the degree of compaction and changed the ratio of single- to double-helix segments with the percent of double-helix segments increasing with the increase of the dioxane level. The changes were attributed to intensification of electrostatic interaction of phosphate groups of one DNA chain with protonated bases of the other DNA chain in the solvent with low dielectric permeability. The results confirmed the importance of protonation of DNA in situ during formation of compact structures. Figures 2; references 17: 7 Russian, 10 Western.

2791/13046  
CSO: 1840/220

### INTERACTION OF BENZTRYPTAMINES AND DNA BY PROTON MAGNETIC RESONANCE WITH USE OF LANTHANIDE SHIFT REAGENT

[Moscow BIOFIZIKA in Russian Vol 30, No 6, Nov-Dec 85 (manuscript received 29 Jan 85) pp 943-947

[Article by T.A. Babushkina, A.M. Vasilyev, V.F. Zolin, L.G. Koreneva and L.B. Shagalov, Institute of Radio Engineering and Electronics, USSR Academy of Sciences, Moscow; Institute of Biophysics, USSR Ministry of Health, Moscow]

[Abstract] Lanthanide shift reagent was used to study the interaction of substrates and DNA. Chemical shifts of H nuclear magnetic resonance vary

in the presence of lanthanide shift reagent. If the substrate reacts with DNA, its addition causes further shifts of nuclear magnetic resonance and the conformation of the substrate and its interaction with the DNA may be judged by the nature of change of chemical shifts in the presence of lanthanide shift reagent and DNA. This method was used to study benztriptamines. A complex of ytterbium and pyroxaldene aspartic acid was used as a lanthanide shift reagent. The 4,5-benztriptamine interacted with the DNA and this impaired the lanthanide shift reagent-substrate interaction. The 6,7-isomer did not interact with the DNA. The different behavior of these isomers is described and discussed. It is emphasized that 4,5-benztriptamine possesses radioprotector properties while the 6,7-isomer does not. Figures 2; references 10: 3 Russian, 7 Western.

2791/13046  
CSO: 1840/220

#### POSSIBLE MECHANISMS OF EFFECT OF EXTERNAL ELECTROSTATIC FIELD ON DNA ELECTROCONDUCTIVITY

Moscow BIOFIZIKA in Russian Vol 30, No 6, Nov-Dec 85 (manuscript received 6 Jun 84) pp 955-958

[Article by O.V. Oganessian and G.G. Artsruni, Yerevan State Medical Institute]

[Abstract] The effect of an external electrostatic field on the electro-physical properties of dry DNA fibers is described and discussed. Volt-ampere characteristics of seven samples of dry DNA fibers of bovine spleen were studied before and during the effect of an external electrostatic field. Voltage of the electrostatic field varied from 0-2.6 kV/cm. The electroconductivity of the DNA samples began to increase at a specific threshold voltage (from 1.6-2.1 kV/cm). This increase of electroconductivity of the DNA samples was not associated with an increase of mobility of the charge carriers. The effect is attributed to Frenkel's thermoelectronic ionization. Figures 4; references 14: 10 Russian, 4 Western.

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CSO: 1840/220

UDC 577.37

#### RETINAL-SENSITIZED PHOTOOXIDATION OF RHODOPSIN

Moscow BIOFIZIKA in Russian Vol 30, No 6, Nov-Dec 85 (manuscript received 19 Mar 84) pp 995-999

[Article by A.V. Starostin, I.B. Fedorovich and M.A. Ostrovskiy, Institute of Chemical Physics, USSR Academy of Sciences, Moscow]

[Abstract] Kinetics of formation of radicals of sulfhydryl groups of cysteine and rhodopsin were studied by spin trapping in a model system (a



solution of transretinal and cysteine in ethanol) and in the photoreceptor membrane. Suspensions of bovine retina rods were obtained, washed in distilled water and precipitated at 250,000 g for 30 minutes. Samples (20  $\mu$ l) were irradiated by light ( $\lambda = 365$  nm) with a 41.8 J/cm<sup>2</sup> dose directly in an RE-1306 radiospectrometer resonator. Photooxidation of rhodopsin occurred according to a free-radical mechanism. The longer lifetime of the triplet state of retinal in the photoreceptor membrane was attributed to the difficulty of its deactivation due to inclusions in the protein in comparison with retinal in solution. Oxidation of cysteine and rhodopsin included both direct interaction of the sensitizer and the oxidation substrate without oxygen participation and with singlet oxygen participation. The rate constant of photooxidation of rhodopsin with oxygen participation was greater than that without oxygen participation. Figures 5; references 19: 14 Russian, 5 Western.

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CSO: 1840/220

UDC 537.363:577.1

#### PUTATIVE MECHANISM FOR CHANGES IN ERYTHROCYTE ELECTROPHORETIC MOBILITY DURING DONOR BLOOD STORAGE

Moscow KOLLOIDNYY ZHURNAL in Russian Vol 48, No 5, Sep-Oct 86 (manuscript received 15 Feb 84) pp 957-961

[Article by V.L. Sigal, Institute of Oncological Problems, Ukrainian SSR Academy of Sciences, Kiev]

[Abstract] Theoretical and experimental information is reviewed on the factors leading to diminished electrophoretic mobility of erythrocytes in stored donor blood. Correlation of changes in the zeta potential of erythrocytes due to adsorption of blood proteins and peptides, as well as preservatives, and changes in electrophoretic mobility have demonstrated a cause-and-effect relationship. Accumulation of a macromolecular layer of the adsorbed substances leads to diminished mobility, with calculations showing that a ca. 30% reduction in mobility correlates with ca.  $5.9 \times 10^{-10}$  m thick adsorbent layer. Recoveries of normal electrophoretic mobility values may be achieved by percolation of the erythrocytes through activated carbon columns for removal of a significant portion of the adsorbed matter. Figures 1; references 20: 11 Russian, 9 Western.

12172/13046  
CSO: 1840/264

## BIOTECHNOLOGY

### BIOTECHNOLOGY IN PETROLEUM INDUSTRY

Baku BAKINSKIY RABOCHIY in Russian 4 Dec 86 p 2

[Article by S. Ismaylova, ELM correspondent, Baku: "Invisible Laborers"]

[Abstract] Application of biotechnology in the petroleum industry has been found to have many direct and indirect benefits. The most obvious deal with metabolic transformation of hydrocarbons to more useful products, as well as in the production of single-cell proteins. In addition, other advantages include the use of certain microorganisms as biocides to prevent fouling of drilling, storage, and other equipment used in the petroleum industry. One of the more obvious developments has been the use of microorganisms for oil spill control. More extensive applications of biotechnology has been in the recovery of metals from poor ores, in sewage treatment, and in the control of algal bloom in water reservoirs, to name just a few obvious benefits of biotechnology.

12172/13046

CSO: 1840/271

UDC 579.873.71.083.134:615.33.012.6

### OPTIMIZATION OF CONDITIONS OF PRODUCTION AND REGENERATION OF PROTOPLASTS OF STRAIN STREPTOMYCES FRADIAE 3830 PRODUCING FEED ANTIBIOTIC TYLOSIN

Moscow ANTIBIOTIKI I MEDITSINSKAYA BIOTEKHNOLOGIYA in Russian Vol 30, No 12, Dec 85 (manuscript received 12 May 85) pp 883-887

[Article by I.I. Rodinova, Yu.A. Tyrsin, Ye.N. Oreshkin, I.M. Gracheva and V.N. Danilenko, All-Union Scientific Research Institute of Antibiotics, Moscow, Moscow Technologic Institute of the Food Industry]

[Abstract] New methodological approaches have been developed in recent years for Streptomyces, significantly expanding capabilities for its genetic manipulation. Fusion of protoplasts, transfection and transformation of protoplasts of plasmid or chromosomal DNA allow effective construction of strains of microorganisms with desired properties in vitro. The authors have studied the influence of certain factors on the effectiveness of

regeneration of protoplasts of *Streptomyces fradiae* 3830, a strain which produces the feed antibiotic tylosin, in order to determine conditions for effective regeneration of protoplasts of this strain. Maximum efficiency was obtained by using the mycelium from the transitory phase between exponential and steady states in a medium containing 0.5 M sucrose, 0.05 M  $\text{CaCl}_2$  and 0.09 M  $\text{MgCl}_2$ , achieving 90-100% regeneration. Figures 2; references 19: 3 Russian, 16 Western.

6508/13046

CSO: 1840/294

## ENVIRONMENT

### PURITY OF UNDERGROUND WATERS

Riga NAUKA I TEKHNIKA in Russian No 11, Nov 86 pp 20-22

[Article by Ivan V. Semenov, chief, Underground Water Quality Monitoring Section, Geology Administration, LaSSR]

[Abstract] The article reports on water quality monitoring, which has been carried out in the Latvian SSR since 1979. Maximum permissible concentrations (MPC) for both general mass pollutants and particularly-toxic waste products are monitored. Observation sites that are tailored to the type of pollutants being monitored check the pressure and levels of contiguous water-bearing strata, the filtering qualities of soils, and absorption and diffusion properties in various regions of Latvia. Test wells are drilled individually or in patterns as needed. A third type of observation post covers natural ecosystems where ground-water pollution may occur from agricultural or urban sources, while a fourth type endeavors to determine base quality standards of water without regard to MPC levels. Ground water temperature, acidity and oxygen content, electrical conductivity and clarity are monitored by automated equipment, and selective electrodes determine suspended particles of copper, fluoride, nitrates, chlorine, cyanide, sulfuric acid, ammonia, etc. A problem of considerable magnitude that is now receiving attention is that of dump sites that came into being before rigorous controls were initiated to protect the environment. Elimination of contaminants already introduced into ground water is another top priority for researchers in this field in the USSR.

12131/13046

CSO: 1840/233

## HUMAN FACTORS

### HUMAN FACTOR IN ENGINEERING WORK

Riga NAUKA I TEKHNKA in Russian No 10, Oct 86 pp 8-10

[Article by Emiliya Sergeyevich Chugunova, Department of Social Psychology, Leningrad State University imeni A.A. Zhdanov, Candidate of Psychological Sciences]

[Abstract] Methods developed to predict probable success of a person in engineering work and especially in engineering administrative work are described and discussed. The method emphasizes development of generalized models of an engineer. Such models, developed at the Department of Social Psychology, Leningrad State University imeni A.A. Zhdanov, accurately predict a person's capacity to become a successful engineer. These models differ significantly for men and women. Some of the differences in qualifications of males and females as future engineers are described and discussed and a sample personality sketch for a successful male and female engineer is presented. The models have been tested in different parts of the Soviet Union and are being used extensively in practice.

2791/13046  
CSO: 1840/204

UDC 577.391:621.375.8;599.323.4

EFFECTS OF LOCAL LASER IRRADIATION ON ENZYMES IN GLUTAMIC ACID PATHWAY IN  
RAT TISSUES

Moscow RADIOBIOLOGIYA in Russian Vol 25, No 5, Sep-Oct 85 (manuscript received  
14 May 84) pp 678-680

[Article by A.T. Pikulev, T.N. Zyryanova, V.M. Lavrova, V.A. Mostovnikov and  
I.V. Khokhlov, Belorussian State University imeni V.I. Lenin; Institute of  
Physics, Belorussian SSR Academy of Sciences, Minsk]

[Abstract] The increasing application of lasers in medical practice led to  
an assessment of the systemic effects of helium-neon laser irradiation on  
outbred rats in terms of changes in enzymes involved in glutamic acid  
metabolism. The animals were irradiated either in the parietal area of the  
head or in the epigastric region, with subsequent monitoring of the brain  
and liver activities of cytoplasmic and mitochondrial aspartate aminotrans-  
ferase and glutamate dehydrogenase. Generally, low intensities (17 mW) were  
innocuous at both sites with irradiation times of less than 10 min. Some  
differences were noted with 20 min exposures, and some enzymatic changes were  
further intensified with 30 min exposures. The overall pattern was one of  
enhanced activities. However, irradiation of the parietal region induced  
changes both in the brain and liver, whereas the effects of epigastric  
irradiation were limited to the liver. Figures 1; references 5: 4 Russian,  
1 Western.

12172/13046  
CSO: 1840/253

THERAPEUTIC ELECTROSTIMULATION IN SPINAL CORD INJURIES

Moscow FIZIOLOGIYA CHELOVEKA in Russian Vol 12, No 1, Jan-Feb 86 (manuscript received 13 Apr 85) pp 165-167

[Article by F.A. Gurchin, S.V. Medvedev, A.G. Naryshkin, V.Yu. Puzenko and Ya.G. Abdullayev, Institute of Experimental Medicine, USSR Academy of Medical Sciences, Leningrad; Leningrad Institute of Information Sciences and Automation, USSR Academy of Sciences]

[Abstract] Clinical therapy utilized electrostimulation of the spinal cord in two cases of spinal cord injury. One case (male) involved compression injury at the D-12 and L-1 level, the other (female) involved a giant tumor at the cauda equina. Both cases were managed in the conventional manner, including laminectomy. From two to six packets of gold electrodes were inserted either directly into the cord or used subdurally to deliver various modalities of electric stimulation (1-140 Hz 0.1-1 sec pulses at a potential of 5-20 V). Systematic application of electrostimulation for 2 months resulted in recovery of background 10-12 Hz activity in the spinal cord, as well as alleviation or disappearance of pain. In addition, muscle tone of the lower extremities improved, atrophy was alleviated, and onset of continence was obtained. These preliminary findings suggest that implanted electrodes show promise as a therapeutic modality in spinal cord injuries. Figures 2; references 8: 4 Russian, 4 Western.

12172/13046

CSO: 1840/246

UDC 577.391;599.323.4

PATHOLOGICAL ANATOMICAL CHANGES IN RATS DURING COMBINED RADIATION AND  
CHEMICAL INJURY

Moscow RADIOBIOLOGIYA in Russian Vol 25, No 6, Nov-Dec 85 (manuscript  
received 30 Jul 84) pp 828-832

[Article by V. P. Voytsova, Institute of Biophysics, USSR Ministry of  
Health, Moscow]

[Text] Radiobiology literature has presently amassed a large number of reports on the effects that various radionuclides as well as total external gamma- and neutron radiation have on the organism [1 -- 3]. There is also a good deal of information available on the effects of chemical substances on the organism [4, 5]. However, there are as yet only a few works in the literature that deal with the combined effects of radiation and chemical factors [6].

The purpose of the present work was to undertake a pathological anatomical study of rats repeatedly exposed to the combined effects of pesticides and gamma-irradiation..

Materials and Method

The experiment was set up for white male rats aged three to three and one-half months at the time of the initial observation. Pesticides of various types were administered orally (Chlorofos as an aqueous solution, Lindane as an oil emulsion (sunflower seed oil), TMTD (thiram) as a suspension in a 1% starch solution). The rats were irradiated on an IGUR instrument at a dose capacity of 11.4 s Gr-roentgen/sec. Two series of tests were set up to study the separate and combined effect of the indicated factors.

In the first series of tests (three groups) each rat, over a period of five days, received a daily dose of 340 mg/kg of Chlorofos, 100 mg/kg of Lindane or 640 mg/kg of TMTD which corresponded to 1/2 the LD<sub>50</sub>. The total dose was equal to 2.5 LD<sub>50</sub>. As is known, in toxicological testing, parts of the effective doses are selected in order to obtain tentative estimates of the joint effects of two or more factors, on the assumption that their effect would be equivalent to the full dose of each factor. This reasoning was the basis of the second series of tests which included three groups of rats. The animals of this group were exposed to daily doses of irradiation over a five-day period at a dose of 1/4 LD<sub>50</sub> (175



sG-roentgens). Immediately after they were irradiated they were given Lindane, Chlorofos or TMTD at doses equivalent to  $1/4 LD_{50}$ . The total five-day dosage was equivalent to 2.5 times the  $LD_{50}$ .

The experiment included six test and two control (only irradiation and intact) groups: There was a total of 160 rats in the experiment. The animals were examined 1, 3, 7, and 15 days after the first exposure in groups of three on the site where they were killed by ether. The examinations of the animals focused on their behavior, external signs of injury, and included a pathological anatomical investigation. Segments of the liver, kidneys, heart, lungs, spleen, and sometimes brain, were taken for histological analysis. The test material was fixed in a 10% solution of formalin and sealed in paraffin. The histological preparations were dyed with hematoxylin-eosin.

### Results and Discussion

The administration of Lindane at  $1/2 LD_{50}$  for five days resulted in acute poisoning and rapid (in the first seven days) death of the animals. The external signs of injury corresponded to those described in the literature, and took the form of excitation which later changed to deep depression, tremor, twitching, hypersalivation, and sometimes corneal turbidity. The observed pathoanatomical changes in the organs were in accord with the existing literature data [4] which indicate that the liver is primarily involved in poisoning by organic chlorine compounds (Lindane). Lindane's hepatotropy was also confirmed by biochemical studies.

As demonstrated by the results of our experiment, the liver of the observed animals was the site of toxic injury which in the first period was characterized by protein dystrophy (first day) which later was transformed into fine and medium droplet fatty overgrowth (third day), and later into typical toxic dystrophy (seventh day, Diagram, B). Extensive myocardiodystrophy was noted at the same time. No morphological disturbances were observed in the other organs throughout the entire experiment.

The administration of TMTD to the rats, continued for five days at a daily dose of  $1/2$  the  $LD_{50}$ , was accompanied by acute poisoning symptoms starting on the second day of the experiment. The first animals died at a total dose of 1.5 times the  $LD_{50}$  (third day). All of the animals died by the seventh day of observation. One day after the administration of TMTD, external manifestations of rats' condition included nasal discharge, lacrimation, pronounced plethora of the eyeball and its membranes, and depression. A pathoanatomical examination of these rats demonstrated that injury to the duodenum plays a leading role in the outcome of acute TMTD poisoning. Ulcerative-necrotic duodenitis developed proximally to the duodenum (Diagram, A). In most cases this developed into a perforated ulcer which was complicated by acute peritonitis involving the inflammatory process of the surrounding organs (liver, spleen, pancreas, etc.). The course took on a septic character which contributed to the rapid death of

the experimental animals. There is no similar information in the literature about the action of TMTD, except to point out the possibility of focal necroses in the mucous membrane of the stomach [7]. One should note that in our experiment too, inflammation began from the stomach, then rapidly spread to the pylorus, and then to the wall of the duodenum. The changes induced by TMTD in the other organs were only slightly characteristic of protein dystrophy. Slight perivascular edema and occasional erythrocyte diapedesis were observed in the brain.

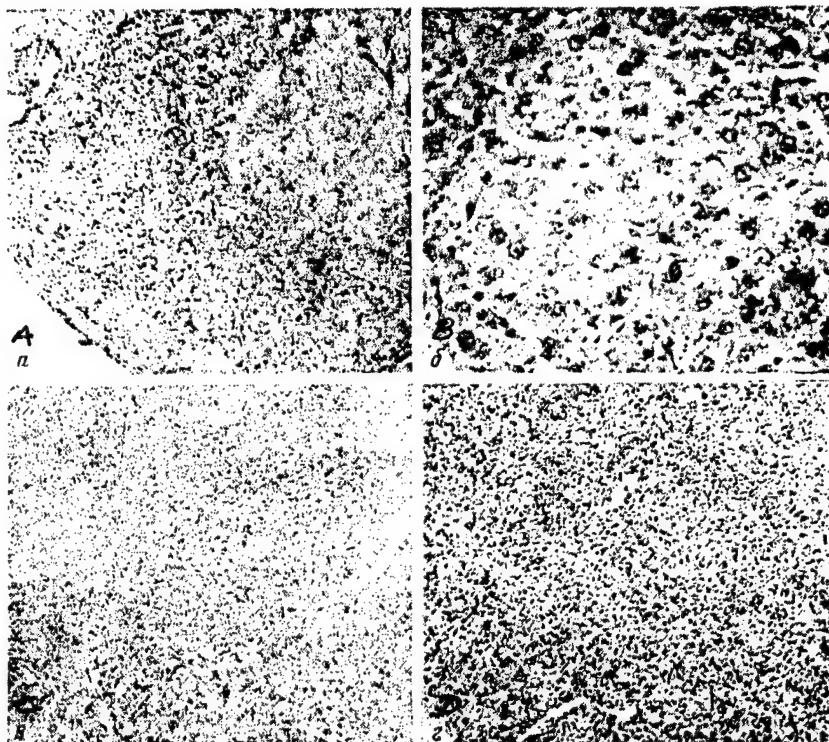


Diagram 1. Certain Pathoanatomical Changes During Radiation and Chemical Injury in Rats

A -- ulcerative-necrotic duodenitis, TMTD at  $1/2 LD_{50}$  doses for five days (fifth day) B -- toxic injury of the liver in repeated Lindane exposure (seventh day); C -- spleen, intact control; D -- spleen, destruction of white pulp. Chlorofos in combination with gamma-irradiation (seventh day). Magnification: A, C, D -- 120, B -- 400.

A quite different reaction in the rats was induced by Chlorofos administered at the same dose as for the aforementioned pesticides. The animals outwardly appeared to be healthy and there were no deaths during the entire experiment. However, after each administered portion of Chlorofos, the rats exhibited symptoms indicative of CNS responses (depression during the first two to three hours). It is known that organic

phosphorus compounds, such as Chlorofos, are neurotropic compounds which suppress cholinesterase activity. This is clinically manifested in the early stage as depression of the animals whose intensity and duration as well as the outcome of the intoxication, depend on the dose of the pesticide. As our previous study has shown, the rat brain is severely injured by a single administration of Chlorofos at the LD<sub>50</sub> dose. Section of the brain demonstrated extensive hemorrhage into the soft tissues of the cranial fornix and pronounced cerebral edema which expanded the brain's size to such an extent that when the skull was sectioned it came out of its cavity. Microscopic examination demonstrated cerebral membrane dispersion, plethora, stasis, plasma infiltration of vascular walls, hemorrhage and erythrocyte diapedesis, and perivascular and pericellular edema. When fractional doses of Chlorofos were administered, the noted changes in the brain were only slight.

Our pathoanatomical examination of the other organs after the repeated administration at a daily dose of 1/2 the LD<sub>50</sub> established that only the liver and spleen exhibited morphological changes that warranted attention. The liver had an outwardly variegated color and seemed only slightly traumatized. The histological preparations, especially on the third and seventh days, demonstrated that the hepatocytes exhibited a structure characteristic of toxic dystrophy, i.e., the cytoplasm was coarsely clumped and there were no vacuoles. By the end of the experiment, the indicated morphological changes were significantly lessened. The architectonics of the spleen resembled that of intact rats, although some white pulp hyperplasia and increased number of megakaryocytes were observed on the seventh and fifteenth days.

When the rats were exposed to the joint effect of radiation and chemical injury where the animals received a daily dose of one of the pesticides at 1/4 of the LD<sub>50</sub> for five days and gamma-irradiation at 1/4 LD<sub>50/30</sub>, the intensity of the animals' reaction corresponded to the reaction observed when they were given repeated doses of pesticides only and exhibited the same pathoanatomical signs. Nevertheless, there were differences. For example, when Lindane was combined with irradiation, the morphological reaction in the organs, particularly in the liver, shifted in time from the first day (as was the case when Lindane alone was administered) to the third day.

Our study of the rats exposed to repeated TMTD doses at 1/4 the LD<sub>50</sub> and gamma-irradiation at 1/4 the LD<sub>50/30</sub> (for five days) would seem to indicate that such exposure had an aggravated effect. This is evidenced by the uniformly high mortality and intense degree of pathological changes induced in the rats by either separate or joint exposure to those substances even though the pesticide dose in this case was different. None of the rats was killed by simultaneous exposure to radiation and Chlorofos or by the administration of Chlorofos alone. However, some sluggishness in the animals was noted by the end of the experiment, and fine- and medium droplet fatty dystrophy had developed in the liver by this time.

Lymphopoeisis suppression was a common pathoanatomical symptom in all combined exposures as well as in irradiation alone. Lymphocytes in the white pulp of the spleen from the peripheral thymus-dependent zone disappeared during the first days after exposure, and the cell count of the central region of the follicles was somewhat reduced. The degree of cell destruction increased as the dose of combined exposure was increased. The architectonics of the splenic white pulp was markedly disrupted by the third day of observation ( $3/4 LD_{50} + 3/4 LD_{50/30}$  of gamma-irradiation): Zone demarcations were absent and only the central arteries were retained (Diagram, D). A similar histological structure was observed up to the seventh day. Rather active processes of lymphoid tissue regeneration in the form of diffusely scattered and variably sized fields of lymphocytes were noted two weeks after exposure to irradiation with Lindane or Chlorofos. No lymphocyte repopulation of the splenic white pulp was observed throughout the observation period when the animals were exposed to a combination of gamma-irradiation and TMTD.

Thus, the results obtained from our pathoanatomical study of rats exposed to the combined effects of radiation and chemical etiology demonstrated that such exposure produced no changes that were different from those obtained when the animals were injured by pesticides or irradiation alone. The intensity of the observed effects for both separate and combined exposure was found to be the same. The only difference was that in some cases the effects were delayed when irradiation was combined with Lindane, whereas in others (TMTD and radiation) the changes occurred at the same time as in the case of exposure to TMTD alone. The pathomorphological picture in the rats after their exposure to Chlorofos and irradiation did not significantly differ neither in time nor intensity from the picture obtained by the separate effect of those factors.

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6289

CSO: 1840/255

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COMPREHENSIVE BRAIN STUDIES BASED ON COMPUTERIZED TOMOGRAPHY OF EPILEPTICS

Moscow FIZIOLOGIYA CHELOVEKA in Russian Vol 12, No 1, Jan-Feb 86 (manuscript received 27 Jul 85) pp 141-145

[Article by D.Ye. Dyskin, Military Medical Academy imeni S.M. Kirov, Leningrad]

[Abstract] In order to obtain a better understanding of the pathological processes in epilepsy, a comprehensive study was conducted on 112 epileptics ranging in age from 14 to 65 years. The study encompassed traditional methods of investigation (EEG, clinical observations, pneumoencephalography), as well as computer tomography (CT) and dynamic CT (DCT). CT studies of the head revealed atrophic processes of the brain in 31 patients (27.7%), brain tumors in 16 (14.3%), local vascular pathology in 8 (7.1%), calcification in 4 (4.6%), midbrain pathology in 3 (2.7%), brain membrane adhesions in 2 (1.8%), and lack of discernible anatomic pathology in 48 cases (42.9%). Pneumoencephalography had failed to reveal any pathology in 13.6% of the cases. DCT demonstrated that in 77.7% of the epileptogenic foci detected by EEG, regional blood flow was diminished. The combination of CT and DCT with the more conventional neurologic methods of investigation made possible detection of brain changes in more than 90% of the patients with epileptic and epileptiform seizures. Furthermore, more refined definition of the type of brain pathology involved should facilitate a more specific therapeutic approach. Figures 2; references 17: 8 Russian, 9 Western.

12172/13046

CSO: 1840/246

UDC 577.113:547.963.3.54.05:578.233.7:578.815.1:579.252.5

PRODUCTION AND PROPERTIES OF RECOMBINANT DNA BASED ON FILAMENTOUS PHAGE-  
PLASMID HYBRID

Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol 12, No 1, Jan 86 (manuscript  
received 16 Sep 85) pp 116-123

[Article by G.R. Titeyeva and Yu.A. Berlin, Institute of Bioorganic Chemistry  
imeni M.M. Shemyakin, USSR Academy of Sciences, Moscow]

[Abstract] In vitro recombinants containing bacteriophage M13 and colicino-  
genic plasmids were studied to evaluate vector capacity of the phage and to  
explain some properties of DNA with two different replicons. In some cases,  
filamentous phage M13mp2 and plasmid pUR222 (Ap<sup>R</sup>) were used. Both of these  
DNA's contained identical nucleotide sequence, about 800 bp in length,  
including the distal end of lacI gene, lacPD segments and lacZ gene  
proximal region coding for 145N-terminal aminoacid residues, providing  
 $\alpha$ -complement. This effect could be cancelled by polynucleotide insertion  
of EcoRI site in the lacZ gene segment. The isolated recombinant DNA  
transmitted resistance to ampicillin and appeared to be a linear double  
stranded molecule joining the phage and plasmid genomes in an equimolar  
ratio. Bacterial cultures obtained during transformation of hybrid DNA of  
the F<sup>+</sup> and F<sup>-</sup> hosts contained a nucleoprotein from which, after precipita-  
tion and deproteinization, the same hybrid DNA could be isolated. Thus,  
this DNA was shown to be capable of forming a protein coat with creation of  
a phagelike particle as well as leaving either of the F<sup>+</sup> or F<sup>-</sup> host cells.  
These results led to the hypothesis that formation of such recombinants  
under natural conditions may be one of the reasons for rapid cell adapt-  
ability to external conditions, including development of drug resistance.  
Figures 5; references 33: 2 Russian, 31 Western.

7813/13046

CSO: 1840/218

EFFECTS OF WHOLE-BODY IRRADIATION WITH LOW-INTENSITY MICROWAVES ON  
MORPHOLOGICAL, FUNCTIONAL AND CYTOCHEMICAL CHARACTERISTICS OF LEUKOCYTES

Moscow RADIOBIOLOGIYA in Russian Vol 25, No 5, Sep-Oct 85 (manuscript  
received 11 Nov 84) pp 645-649

[Article by M.I. Rudnev and N.M. Gonchar, Kiev Scientific Research Institute  
of General and Communal Hygiene imeni A.N. Marzeyev]

[Abstract] In view of the ubiquitous nature of microwave exposure, outbred rats and guinea pigs were employed to assess the effects on leukocytes and expand the body of knowledge pertaining to the radiobiological aspects of this form of radiation. The animals were subjected to low-intensity irradiation on the order of  $1-500 \mu\text{W}/\text{cm}^2$ , either in the continuous (2375 MHz) or pulse (9400 MHz) modes. In both species, total leukocyte blood counts were not affected after a 90-day period of irradiation. However, a statistically-significant elevation in eosinophils was evident in the rats by day 30, which persisted for 90 days after irradiation was terminated. Concomitantly, monocytes and lymphocyte counts were depressed, while those of neutrophils were elevated. In guinea pigs recovery of a normal blood formula was seen within 30 days. Cytochemical and functional studies also demonstrated species differences: In rats neutrophil digestive function was enhanced but phagocytic activity remained unaffected, while in guinea pigs both the digestive and phagocytic activities of neutrophils were enhanced. The  $500 \mu\text{W}/\text{cm}^2$  dose was uniformly inhibitory. The observed effects were interpreted to reflect adaptive changes in response to low-level ( $5-50 \mu\text{W}/\text{cm}^2$ ) electromagnetic exposure. Figures 2; references 12 (Russian).

12172/13046  
CSO: 1840/253



EFFECTS OF TOPICAL APPLICATIONS OF ORGANOPHOSPHORUS PESTICIDE PHOSPHAMIDE ON ACID-SOLUBLE COLLAGEN IN RAT SKIN

Kiev DOKLADY AKADEMII NAUK UKRAINSKOY SSR, SERIYA B: GEOLOGICHESKIYE, KHIMICHESKIYE I BIOLOGICHESKIYE NAUKI in Russian No 10, Oct 86 (manuscript received 30 May 86) pp 59-61

[Article by Yu.I. Kundiyev, academician, UkSSR Academy of Sciences, L.G. Aleksandrova, N.P. Baranov, T.N. Pechenova, T.T. Volodina, N.N. Popova and N.A. Nosal, Institute of Labor Hygiene and Occupational Diseases, UkSSR Ministry of Health, Kiev; Institute of Biochemistry, UkSSR Academy of Sciences, Kiev]

[Abstract] Extensive use of organophosphorus pesticides involving occupational skin exposure led to studies on outbred rats to determine the extent to which phosphamide may be deposited in the skin and its physiological effects. Application of phosphamide to a 4 x 4 cm skin area for 12 h led to marked chemical differences in acid-soluble collagen. After 12 h the lysine and arginine content of collagen decreased from 34.53 to 26.08% and from 49.47 to 43.13%, respectively. Concomitantly, the concentration of threonine increased from 19.65 to 23.82, and of serine from 38.27 to 44.53%. In addition, the carbohydrate component of collagen decreased from 2.11 to 1.7%. Phosphamide was also found to be covalently bound to collagen to a concentration of 0.1%. These observations indicate that phosphamide induced significant changes in the acid-soluble collagen fraction of the skin on application and, furthermore, that the skin serves as a depot site for phosphamide. Figures 2; references 12: 11 Russian, 1 Western.

12172/13046  
CSO: 1840/257

ANTIOXIDANTS AS ANTIARRHYTHMICS

Kiev FIZIOLOGICHESKIY ZHURNAL in Russian Vol 32, No 1, Jan-Feb 86 (manuscript received 22 May 85) pp 24-32

[Article by V.V. Frolkis, R.A. Frolkis, G.Ya. Dubur, Yu.V. Khmelevskiy, V.G. Shevchuk, S.F. Golovchenko, L.S. Mkhitarian, G.S. Voronkov, V.A. Tsiomik, I.V. Lysenko and N.B. Poberezkina, Institute of Gerontology, USSR Academy of Medical Sciences, Kiev; Institute of Cardiology, Ukrainian SSR Ministry of Health, Kiev]

[Abstract] Experimental therapeutic trials were conducted with several antioxidants to assess their efficacy on various models of chemically-induced arrhythmia in rabbits and rats. The underlying reasoning being based on the observations that arrhythmia involves changes in cardiomyocyte membranes, while antioxidants are known to stabilize cell membranes. The following antioxidants were assessed in managing arrhythmia induced by epinephrine, vasopressin, strophanthin, or calcium chloride: sodium 2,6-dimethyl-3,5-diethoxycarbonyl-1,4-dihydronicotinate (I; i.p. LD<sub>50</sub> = 3400 mg/kg (species?)), sodium 2,6-dimethyl-1,4-dihydropyridine-3,5-biscarbonylacetate (LD<sub>50</sub> = 3200 mg/kg), 2,6-ditert-butyl-4-methylphenol (LD<sub>50</sub> = 3000 mg/kg), and alpha-tocopherol. Each of the antioxidants was shown to be effective in alleviating or preventing arrhythmia in the model systems employed, with I judged to be the most effective agent, followed closely by alpha-tocopherol. This class of agents was found effective in mitigating the adverse effects of the arrhythmics on the plasma membranes of the heart, particularly in preventing alterations in the phospholipid composition and ATPase activities. In addition, I and the biscarbonylacetate derivative also functioned as calcium-channel blockers, suggesting that other derivatized 1,4-dihydropyridines should be monitored for similar activity. Tables 7; references 27: 12 Russian, 15 Western.

12172/13046

CSO: 1840/241

## PHYSIOLOGY

### VASOPRESSIN ROLE IN MOTOR FUNCTION

Leningrad LENINGRADSKAYA PRAVDA in Russian 24 Nov 86 p 4

[Interview with G.A. Vartanyan, doctor of medical sciences and director of the Physiology Department of the Institute of Experimental Medicine of the USSR Academy of Medical Sciences by T. Chesanova; date and place not given; first paragraph appears in boldface in source]

[Text] As studies by scholars at the the Institute of Experimental Medicine of the USSR Academy of Medical Sciences have shown, the widely known preparation vasopressin, which is used to regulate water and salt exchange in humans, possesses other amazing properties that have made it possible to look into the "holy of holies" of the organism, the brain. G.A. Vartanyan, doctor of medical sciences and director of the Physiology Department of the Institute of Experimental Medicine of the institute speaks about this in a conversation with our correspondent.

"I will begin by saying that our department, which has been involved in fundamental research on higher nerve activity, has generally not worked with medicinal preparations, including vasopressin. As they say, we didn't look for it, it found us. How? That's an interesting story.

There is probably nothing extraordinary in the fact that humans explain the function of the living from the perspective of their own technical knowledge. In the precomputer era, the brain's operation was explained with the help of terms from the electrical engineering and telephone eras. Processes of induction were mentioned, and the terms "short-circuit" and "temporary connection" were used....

After computers appeared, it became very tempting to view the brain as a complex computer or even two computers since the brain contains two hemispheres that interact when processing information entering from the environment and the organism itself.

However, in recent years ever-increasing numbers of scholars are tending to believe that the brain is not an electrical but rather a chemical "machine." And this means that all of the brain's functions have some biochemical switch at their base. This switch must be "pressed" before the brain can be controlled.

We conducted the following experiment: we taught an animal some habit, let's say, to run for food to the feeder on the right. A conditioned reflex was developed. Then we removed a little of the fluid that surrounds and feeds the brain. We injected it into other animals and confirmed that the process of training this animal now went much faster! It happened that some switch, a chemical agent, helped the brain assimilate a new habit more quickly and affected the training process...."

"And is there a switch involved in impairments in the brain's operations and in diseases?"

"As was discovered, there is. In animals we confirmed those sections of the brain that regulate motion by causing paralysis of the left and right sides of the body. Next, we sampled the spinal fluid of those animals and injected it into healthy animals. Soon motor impairments occurred in them also...."

"Thus, disease is transmitted. And shouldn't the same mechanism be used to treat it?"

The brain operates universally in all situations, under both ordinary and dramatic conditions. Let us say trauma. For the brain, trauma is also information that compels it to readjust with the help of its components that have been preserved in order to compensate for losses and to restore lost functions. The director of our institute, Academician N.P. Bekhterev believes that on the road from disease to recovery after any unfavorable effect, the human brain passes through all stages inherent to training and memory. First it "realizes" the past, then it forms, as we say, a new memory "matrix." What does this mean? For example, if it had 1,000 operating components at its disposal before the trauma, now 950 remain. And the brain must operate using this quantity. So the reason it needs a new memory "matrix" is to adjust to the new conditions. This makes it possible for the brain to restore its functions and explains the duration of the recovery process."

"In such a case, can recovery be hastened?"

"It can if the brain is helped to form its memory of disease more quickly. For this, it is also necessary to find the corresponding chemical switch. As we confirmed, the switch exists in the spinal fluid. But to isolate it in pure form...."

"It's like finding a needle in a haystack?"

"Even harder. The point is that such switches are distinguished by their enormous activity. The brain responds to a meager number of them. However, even the most modern of biochemical methods have not permitted us to understand how small their concentration is.

"Our neurochemists have literally had to gather grains from not one, but a thousand test animals to collect a quantity of substance sufficient for determining the structure of the "culprit" behind motor injury in animals."

"And who did the "secret stranger" turn out to be?"

"To our great surprise it was our good old acquaintance vasopressin. We didn't even suspect vasopressin in the very beginning; it is so well known to medical personnel. This substance regulates kidney function and maintains water and salt balance in the blood. It also affects arterial pressure and regulates the tonus of the vascular wall.

"Several years ago, this neuropeptide had yet another surprise for researchers. It turned out that it accelerates the training process. Experiments conducted in the Military Medical Academy imeni S.M. Kirov confirmed that it is very effective with trauma-induced impairments in memory. And now a new property of this long-known protein has been discovered. It regulates motor functions. As we now understand, it helps the brain form a new memory 'matrix' faster."

"And how can one protein accomplish so many different functions?"

"All the neuropeptides developed in the brain are multifunctional. As in the given case, everything depends on the concentration of vasopressin. Several micrograms are enough to regulate kidney function, doses a thousand times greater are needed to increase arterial pressure, and doses that are a million times less "manage" motor activity. In each specific case, the organism itself selects the quantity of protein necessary."

"The organism is its own pharmacist?"

"Of course. We certainly don't run to a doctor for every little thing. For many little ailments, our organism takes care of itself. And if we want to help it, then we must do so very carefully, using only that quantity of medicine that is of use. It is also important that vasopressin is a substance that is not foreign but is native to the organism and is one that we have taken from the organism's pharmacy, which was created many millions of years ago. Thus it is no sin to look to nature more frequently to see if there is something to learn there."

"And the last question, which will undoubtedly be of interest to many: when will physicians take this old drug and use it for new purposes?"

"Up to now, all the experiments I've mentioned have only been done on animals. Clinical tests and verifications must be completed before the pharmacology committee decides to use the drug to treat motor impairments. In addition, it should be noted that vasopressin has only been implicated in right-side dysfunctions. As far as left-side impairments are concerned, they are caused by another substance that we have still not found and that we are still searching for. Thus, there is still a lot of work ahead...."

12794

CSO: 1840/201

UDC 576.35:576.314

DIMINISHED ACCUMULATION OF FLUORESCENT DYES IN CELLS WITH MULTIPLE DRUG RESISTANCE

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 291, No 4, Dec 86 (manuscript received 13 May 86) pp 989-991

[Article by A.A. Neyfakh and A.Yu. Aleksandrova, Moscow State University imeni M.V. Lomonosov]

[Abstract] Mammalian cells cultured in presence of cytostatic agents often develop multiple drug resistance. Such cells exhibit amplification of certain genome fragments which is the genetic reason for this phenomenon. Possible biochemical mechanism for this is even less clear; some of the studies with radio-labeled cytostatic agents concluded that this resistance may be due to their compartmentalization in the cytoplasm of resistant cells. In the present work, accumulation and intracellular localization of various fluorescent dyes was studied in resistant cells: Dzhungar hamster sensitive line DM-15, selected lines Act-10 and Act-12 (resistant to actinomycin D), revertant line Act 10<sup>rev</sup> and colchicine resistant cells DM-711. Most significant differences were observed with fluorescent agent rhodamine 123: Sensitive cells exhibited bright fluorescence of mitochondria, the resistant ones did not; other dyes gave qualitative differences at best. This difference was due to the changes in plasmatic membrane properties. Agents known to depress cell resistance to cytostatic drugs led to penetration of the dye and staining of mitochondria. A conclusion was reached that diminished accumulation of fluorescent dyes by the resistant cells is due to their elimination from the cytoplasm and that such cells can also expel cytostatic drugs by this mechanism. Figures 1; references 11: 2 Russian, 9 Western (1 by Russian authors).

7813/13046

CSO: 1840/227

REVERSIBLE REORGANIZATION OF CULTIVATED CELLS CYTOSKELETON INDUCED BY  
12-0-TETRADECANOYLPHORBOL-13-ACETATE

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 291, No 4, Dec 86 (manuscript received 26 May 86) pp 985-988

[Article by V.B. Dugina, Yu.M. Vasilyev and Academician I.M. Gelfand, Moscow State University imeni M.V. Lomonosov]

[Abstract] One of the principal properties of cytoskeletal structures is their ability to reorganize rapidly, which in many cases is caused by membrane signals induced by the action of external molecules upon cell receptors. 12-0-Tetradecanoylphorbol-13-acetate (TPA) is a selective activator of one of the key membrane regulator enzymes: protein kinase C. A new type of TPA-induced cytoskeleton reorganization was observed in this study: cell separation into a labile portion, rich in actin, and a stable branch rich in microtubules. The following speculative mechanism was proposed for this: protein kinase C phosphorylates a number of intracellular proteins, including some cytoskeletal ones which contain some as yet unknown molecules responsible for the interaction between microtubules and intermediary filaments with actin cortex. The TPA effect was found to be reversible, lasting only 8-10 hours; after that period, the fine offshoots are contracted by some as yet unknown mechanism. Figures 2; references 10: 4 Russian, 6 Western (1 by Russian authors).

7813/13046  
CSO: 1840/227

UDC 612.821.7

COMPARATIVE ANALYSIS OF CHANGES IN INTERCENTRAL BRAIN INTERRELATIONSHIPS  
AFTER ADMINISTRATION OF  $\delta$ -SIP (DELTA-SLEEP-INDUCING PEPTIDE) AND ACTH

Leningrad FIZIOLOGICHESKIY ZHURNAL SSSR IMENI I.M. SECHENOVA in Russian Vol 22, No 1, Jan 86 pp 116-131

[Article by N.M. Malysheva, S.I. Kashtanov, S.V. Yeposhkin and I.I. Mikhaleva, Laboratory of Emotion Physiology, Institute of Normal Physiology imeni P.K. Anokhin, USSR Academy of Medical Sciences, Moscow; Department of Normal Physiology, State Medical Institute, Archangelsk]

[Abstract] The changes occurring in the intercentral relationships among ventromedial hypothalamus, the limbic system and the reticular formation of rabbit brain after systemic administration of  $\delta$ -sleep-inducing peptide (SIP) and ACTH were studied. Effect of these peptides on the functional state and dynamic formulation of interactions between these structures varied. Administration of ACTH changed the activity of the ventromedial nucleus of the hypothalamus, lowering the  $\delta$ -activity, while increasing the  $\alpha$ - and

$\beta$ -activity. The EEG spectral frequencies shifted towards the diminution of  $\theta$ -rhythm. A consolidation occurred between limbic formations of the dorsal hippocampus, lateral partition and basal mandelike structures. Administration of  $\delta$ -SIP also resulted in new functional relationship among these structures concentrating on correlations of  $\delta$ -rhythm: consolidation between hippocampus and the partition, partition and mandelike structure and between the structures of limbic system and reticular formation. Overall, administration of ACTH led to consolidation of these interrelationships while  $\delta$ -SIP caused disconnections of their functional ties. Figures 3; references 12: 10 Russian, 2 Western.

7813/13046  
CSO: 1840/230

#### EFFECTS OF NEUROREGULATORS ON HIPPOCAMPAL SYNAPTIC ACTIVITY

Moscow USPEKHI FIZIOLOGICHESKIKH NAUK in Russian Vol 16, No 4, Oct-Dec 85  
pp 35-48

[Article by V.G. Skrebitskiy, Brain Institute VNTs PZ (All-Union Scientific Center for Mental Health), USSR Academy of Medical Sciences, Moscow]

[Abstract] The article summarizes research on chemical compounds that serve as neuroregulators of synaptic flexibility mechanisms affecting memory and learning processes, with special emphasis on noradrenalin, inhibitors of phosphodiesterase and several neuropeptides. Results of original research are also summarized. The effects of neuroregulators were assessed on the basis of responses to extra- and intrahippocampal factors, as well as the duration of post-tetanol potentiation. Data confirm the modulating role of noradrenalin in hippocampal synaptic activity, and particularly in its restructuring. Secondary neuroregulatory systems in which NA functions through beta-adrenoreceptors to activate the enzyme adenylatcyclase show that the effect of adenosine on neuron reactivity varies and can be blocked by theophyllin, in which case dibutyryl-cyclic adenosinemonophosphate (cAMP) causes increased cellular responses. Effects of phosphorylation of protein and the role of  $Ca^{++}$  ions in that reaction are discussed. Neuropeptides, such as vasopressin synthesized in the neurons of supraoptic nuclei and transported to the hypophysis, are shown to have an important role in memory. Another important enzyme whose role is not completely understood is encephaline. References 58: 11 Russian, 47 Western.

12131/13046  
CSO: 1840/216



## CURRENT IDEAS ABOUT NONTRADITIONAL NEUROENDOCRINE STRESS MECHANISMS

Moscow USPEKHI FIZIOLOGICHESKIKH NAUK in Russian Vol 16, No 4, Oct-Dec 85  
pp 106-118

[Article by V.D. Slepushkin, Yu.B. Lishmanov, G.K. Zoloyev and I.A. Prum,  
Laboratory of Pathophysiology of Extreme States, Siberian Branch, All-Union  
Cardiological Scientific Center, USSR Academy of Medical Sciences, Tomsk

[Abstract] The article reviews published and personal results of study of trauma and acute myocardial ischemia, showing that concentrations of the immunoreactive parathyroid hormone in both human and test animal blood first increase, then decline steadily. The authors interpret this to mean that the initial hyperfunction caused by stress is quickly followed by a more promising and lasting protective glandular adaptation. The role of calcium ions is to stimulate cellular membranes and cause myocardial contractions, and the number of  $Ca^{++}$  cations was found to increase by 30-40% in response to various forms of stress; the calcium cations had a key function in organizing and formulating the test organism's catabolic reaction. Further study showed that the epiphysis initially lost function and declined in size by ca. 40% in initial trauma, then recovered to facilitate the resistant phase by acting on other links in the endocrine system. Calcium and the parathyroid glands interact in this process, while the epithalamo-epiphyseal system actively takes part in the resistant phase. Opioid peptides are regarded to be the most powerful factor braking stress reactions, while leu-enkephaline also plays a role. References 57: 33 Russian, 24 Western.

12131/13046  
CSO: 1840/216

## PARADOXICAL SLEEP-PROTECTION FROM STRESS

Moscow ENERGIYA: EKONOMIKA, TEKHNIKA, EKOLOGIYA in Russian No 9, Sep 86,  
pp 9-11

[Article by V.S. Rotenberg, doctor of medical sciences, V.M. Kovalzon,  
candidate of biological sciences and V.L. Tsibulskiy]

[Abstract] The importance of a combination of active investigative activity and paradoxical sleep in alleviating stressful situations in animals and man is discussed. V.V. Arshavskiy's studies showed the benefit of search activity in rats and rabbits subjected to artificially induced pathological states. It has been shown that active defensive behavior slows experimentally induced myocardial infarction while passive defensive behavior accelerates it. Experiments to judge the effect of deprivation of paradoxical sleep included several dozens of white rats separated into 10 groups, subjected to diverse stressful actions, and 2 control groups. Stressed rats which were deprived of paradoxical sleep lost much weight, their fur roughened and they appeared to be ill. The adrenals were greatly enlarged; the thymus atrophied and

stomach ulcers occurred. After removal of the stressful situation, the rats displayed investigation behavior and the fear level decreased. Experiments have shown that only a combination of a lack of investigative behavior and deprivation of paradoxical sleep could change the emotional behavior of the rats. The role of noradrenalin in animal reaction to stressful situations is discussed. Paradoxical sleep was associated with some optimal level of noradrenalin in the brain. Reduction of noradrenalin level reduces the duration of paradoxical sleep.

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#### BRAIN OPIATE SYSTEM AND MELANOSTATIN EFFECTS

Leningrad FIZIOLOGICHESKIY ZHURNAL SSSR IMENI I.M. SECHENOVA in Russian  
Vol 71, No 8, Aug 85 (manuscript received 8 Oct 84) pp 937-944

[Article by N.Ye. Chepurnova, V.Ye. Klusha, V.M. Borzenkov, D.N. Lapshin, A.Ya. Khatskelevich and S.A. Chepurnov, Chair of Human and Animal Physiology, Biological Faculty, Moscow State University imeni M.V. Lomonosov]

[Abstract] In an attempt to define the mechanism of action of melanostatin (MIF), the behavioral and EEG effects of intraventricular administration were monitored in rats. Administration of 120  $\mu$ g MIF into the lateral ventricle elicited convulsive head jerking, clicking of the teeth, grooming, yawning and eventual abatement of overall motor activity. Computer-based analysis of EEG patterns demonstrated changes in synchronization and desynchronization of ascending nerve impulses, with appearance of generalized changes in both cerebral hemispheres occurring simultaneously regardless of the side of injection. MIF led to an increase in the proportion of slow waves in the limbic formations of the  $\alpha$ -waves in the somatosensory cortex. Priming with morphine (intraventricular) 30 min before MIF administration potentiated the effects of the latter in terms of the parameters under study. However, administration of MIF before morphine led to equivocal results: In some animals the effects of morphine were abolished, and in others merely attenuated. The data on the effects of the morphine and MIF combinations are inconclusive as regards competition for opiate receptors. In addition, the hormonal functions and endocrine consequences of MIF on the limbic system will also have to be accounted for. Figures 5; references 20: 8 Russian, 12 Western.

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CSO: 1840/228

# PROTEIN AND RNA LEVELS IN NEURONAL AND GLIAL ELEMENTS OF N. RAPHE DORSALIS OF GROUND SQUIRREL DURING HIBERNATION

Leningrad FIZIOLOGICHESKIY ZHURNAL SSSR IMENI I.M. SECHENOVA in Russian  
Vol 71, No 8, Aug 85 (manuscript received 20 Aug 84) pp 945-951

[Article by T.N. Golovina, U.M. Malikov, T.Kh. Shortanova and N.N. Demin, Chair of Biochemistry, Kabardino-Balkar State University, Nalchik; Functional Neurochemistry Laboratory, Institute of Physiology imeni I.P. Pavlov, USSR Academy of Sciences, Leningrad]

[Abstract] To obtain a better biochemical understanding of hibernation, the levels of RNA and proteins in glial satellite cells and neurons in the n. raphe dorsalis of the Caucasian ground squirrel (*Citellus pygmaeus*) were determined in August, December and March for hibernating and nonhibernating animals. Comparative analysis of the data demonstrated that, on a per cell volume basis, onset of hibernation is accompanied by profound shifts in the concentration of total proteins and RNA in the cytoplasm. The deviations from baseline values were less pronounced in nonhibernating squirrels. At the peak of hibernation (December) protein levels were markedly depressed in neuronal cytoplasm, and less so in gliocyte cytoplasm. RNA concentration in the neurons was unaffected, but markedly increased in the glial cells. In the prearousal stage (March), with the same rectal temperature (4-6°C), the protein and RNA levels in the neurons showed a marked increase above control values. In the glial elements, the protein concentration rose to exceed the baseline value, while the RNA concentration presented with a decline toward the baseline. These observations indicated depressed protein and RNA metabolism in n. raphe dorsalis at the height of hibernation, and activation of these processes in March prior to arousal. Figures 3; tables 2; references 20: 1 Ukrainian, 13 Russian, 6 Western.

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UDC 612.843

## MECHANISMS OF EARLY LIGHT AND DARK ADAPTATIONS

Leningrad FIZIOLOGICHESKIY ZHURNAL SSSR IMENI I.M. SECHENOVA in Russian  
Vol 71, No 8, Aug 85 (manuscript received 12 Mar 84) pp 965-970

[Article by A.B. Kravtsov and S.V. Kulikova, Chair of Biophysics, Leningrad State University imeni A.A. Zhdanov]

[Abstract] A tachiscopic study was conducted to assess the role of movement (phasic) and form (tonic) analyzers in early light and dark adaptation. The study involved presentation of illuminated triangular images differing in brightness with a test stimulus of 30 msec, and 10 to 800 msec for integration

time analysis. The responsiveness of the visual system was largely predicated on the movement analyzer, with differences among the subjects in responding to an increase or a decrease in baseline brightness due to individual differences in balance of on- and off-inputs into the visual system. Altering the light stimulus may change the relationship between the two types of analyzers. In the case of a sudden change in the adaptation field the sensitivity of the movement analyzer deteriorates. The increase in the threshold sensitivity of the latter leads to the appearance of well-defined peaks of early light and dark adaptation. Temporal integration under such conditions is prolonged and the form analyzer assumes the dominant role. The interaction of the form and movement analyzers may, therefore, determine the adaptability of the visual system. Figures 3; references 18: 1 Bulgarian (in Eng.), 4 Russian, 13 Western.

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UDC 612.135:616-005.1(23.03)

#### STATUS OF MICROCIRCULATION IN HIGH-ALTITUDE BLOOD LOSS

Frunze IZVESTIYA AKADEMII NAUK KIRGIZSKOY SSR in Russian No 4, Jul-Aug 86  
(manuscript received 3 Apr 86) pp 58-62

[Article by N.D. Umrallieva, Institute of Alpine Physiology and Experimental Pathology, Kirghiz SSR Academy of Sciences]

[Abstract] A histological study was conducted on outbred, albino rats to assess the effects of high-altitude adaptation (3200 m) on the microcirculatory responsiveness to a 30% blood loss. Adaptation was performed for 3 to 30 days prior to hemorrhage, with a systemic assessment of the angio-architectonics. The data showed that adaptation itself placed a serious strain on the physiological reserves and diminished the ability of the body to cope with the additional stress of blood loss, with the net hemodynamic adjustments showing deterioration, in going from 3-day to 15-day high-altitude adaptation. By 30 days of adaptation, blood loss was accompanied by less deleterious microcirculatory responsiveness to blood loss as affected by physiological changes induced by an altitude of 3200 m. Figures 2; references 7 (Russian).

12172/13046  
CSO: 1840/214

# INTERRELATIONSHIP OF HEART RHYTHM INDICATORS AND RESISTANCE TO HYPOXIA IN ANTARCTIC POLAR WORKERS

Frunze IZVESTIYA AKADEMII NAUK KIRGIZSKOY SSR in Russian No 4, Jul-Aug 86 (manuscript received 24 Jan 86) pp 63-66

[Article by A.L. Maksimov and T.B. Chernook, Institute of Alpine Physiology and Experimental Pathology, Kirghiz SSR Academy of Sciences]

[Abstract] A cohort of 17 Antarctic workers were evaluated for correlation between heart rhythm indicators and hypoxic resistance. The cohort was differentiated into a group with high resistance (8 individuals, Group I), and moderate resistance (9 subjects, Group II). Evaluation of the parameters and factors of interest demonstrated that, in Group II, sympathetic activity was characterized by an inadequate reduction in activity during daytime and increase in activity in the evening, night and early morning. These facts indicated that Group II individuals were characterized by a less-well-developed 'automatism' and required more frequent involvement of higher centers. Group I individuals demonstrated adequate 'automatism' in conjunction with a higher metabolic rate. As a result, the involvement of the higher centers was at a minimum in Group I subjects and the parasympathetic system predominated in the regulatory processes. In the final analysis, the physiological regulatory systems were under less stress in Group I individuals. A daytime pulse rate of 65 beats/min or less, and a nighttime rate of at least 50 beats/min were found to indicate satisfactory autonomic homeostasis in both groups. Tables 1; references 12 (Russian).

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UDC 612.821

# EFFECTS OF INTENSE, TIME-CONSTRAINED MENTAL EFFORT ON HEMODYNAMICS AND CARDIOVASCULAR FUNCTION

Moscow FIZIOLOGIYA CHELOVEKA in Russian Vol 12, No 1, Jan-Feb 86 (manuscript received 30 Sep 85) pp 65-71

[Article by B.M. Fedorov, Ye.N. Streltsova, T.V. Sebekina and T.M. Sinitsyna, Moscow]

[Abstract] A variety of cardiovascular and hemodynamic parameters were monitored in a group of healthy men subjected to time-constrained intellectual effort in order to assess the effects of such stress on blood supply to the brain. The study involved a cohort of 25 young and middle-aged men required to perform mathematical operations or to demonstrate syntactical skills within a given time frame. The demands on mental acuity in this situation represented a highly stressful situation accompanied by pronounced

cardiovascular and hemodynamic sequelae. The latter included tachycardia, elevated blood pressure, and increased peripheral vascular resistance in some subjects, and the opposite change in vascular resistance in others. In some cases an initial increase in peripheral vascular resistance was subsequently replaced by a decrease. Rheoencephalographic studies provided unequivocal evidence of diminished blood supply to regions of the brain uninvolved in the mental effort (frontomastoidal areas), and enhanced blood flow to the inferior areas (Brodman's area 40). These observations demonstrate the need to vary intellectual activities in order to ensure adequate blood supply to all the brain formations on a uniform basis. References 9: 8 Russian, 1 Western.

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CSO: 1840/246

UDC 612.833.92

#### ENDOGENOUS NEUROPEPTIDES IN CONTROL OF BRAIN MOTOR FUNCTION IN NORMAL AND PATHOLOGIC STATES

Moscow FIZIOLOGIYA CHELOVEKA in Russian Vol 12, No 1, Jan-Feb 86 (manuscript received 11 Jun 85) pp 82-93

[Article by G.A. Vartanyan and Ye.I. Varlinskaya, Institute of Experimental Medicine, USSR Academy of Medical Sciences, Leningrad]

[Abstract] Experimental and clinical data are summarized on the delayed asymmetry factors (DAF) produced by the cerebral cortex and secreted into the CSF. These factors have been identified as 1-2 kdalton peptides that function to regulate muscle tone of contralateral extremities in case of one-sided brain injury. DAF have been identified in the CSF of patients with brain injury, and experimental studies on brain-injured rats have demonstrated that early administration of exogenous DAF leads to earlier recovery of normal locomotion. The physiological effects of DAF appear to involve their direct action on the cortico-spinal motor pathways, with the end effect involving activation of segmental control of muscle tone and inhibition of the contralateral cortex. In normal physiological states, DAF may be involved in fine-tuning symmetrical muscle tone balance. Figures 4; references 28: 17 Russian, 11 Western.

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## HYPOBIOSIS AND FUNCTIONAL COLD THERMORESISTANCE

Moscow FIZIOLOGIYA CHELOVEKA in Russian Vol 12, No 1, Jan-Feb 86 (manuscript received 29 Jul 85) pp 110-124

[Article by N.N. Timofeyev, Institute of Pharmacology, USSR Academy of Medical Sciences, Moscow]

[Abstract] A review is presented of current concepts on the changes in cell membranes that ensure survival of mammals during hibernation or the so-called hypobiotic state. Essentially, primary hypometabolism in mammals--induced by cold exposure--leads to changes in the fatty acid composition of cell membranes consisting of an increase in the proportion of saturated fatty acids. The latter change precedes profound lowering of body temperature and represents a protective mechanism that predisposes to the establishment of fluid foci in the membranes. In the case of rats it has been shown that a reduction in the metabolic rate of 1% results in a  $2 \pm 0.3\%$  increase in the levels of saturated fatty acids (stearic, palmitic) in the tissues. In situations in which the mammalian organism experiences deep hypothermia, such foci assure cellular viability and survival of the animal, while the rest of the membrane undergoes a gel phase transition. At temperatures of ca.  $0^{\circ}\text{C}$  survival depends on administration of antioxidants to maintain the fluid foci in the cell membranes. Such studies have obvious clinical significance both from the therapeutic viewpoint and resuscitation from hypothermic states. Figures 5; references 46: 26 Russian, 20 Western.

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UDC 612.8.014.886.421

## FACILITORY EFFECTS OF VOLUNTARY MOVEMENTS ON VESTIBULOMOTOR REACTION

Moscow FIZIOLOGIYA CHELOVEKA in Russian Vol 12, No 1, Jan-Feb 86 (manuscript received 15 Jan 85) pp 133-140

[Article by B.N. Smetanin, V.Yu. Shlykov and M.P. Kudinova, Institute of Information Transfer Problems, USSR Academy of Sciences, Moscow]

[Abstract] In order to further define the relationship between the vestibular apparatus and voluntary movements, electrical stimulation of the former was assessed in relation to voluntary and involuntary movements. The study conducted on 14 men, 25 to 40 years old, involved electrical stimulation of the vestibular apparatus with right-angle 0.05-3.0 mA pulses, 4 sec in duration, while in the standing position with eyes closed. Voluntary movements--which result in the deviation of the body from the vertical plane and involve the pelvic and trunk musculature--performed during vestibular stimulation, enhanced the vestibulomotor reaction and depressed its threshold several fold.

Body instability per se was not a factor in the facilitory response, and electrical stimulation of the musculature which elicited involuntary movements was ineffective. These observations were taken to indicate the importance of will in affecting the performance of the vestibular apparatus in maintaining body equilibrium. Figures 4; references 12: 5 Russian, 7 Western.

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UDC 612.014

# HUMAN ADAPTATION TO VARIOUS HYPERCAPNIC CONDITIONS IN RELATION TO SALIVARY ELECTROLYTE DYNAMICS AND RENAL FUNCTION

Moscow FIZIOLOGIYA CHELOVEKA in Russian Vol 12, No 1, Jan-Feb 86 (manuscript received 10 May 84) pp 157-164

[Article by N.A. Agadzhanian, A.I. Yelfimov and Z.B. Minina, Moscow]

[Abstract] The effects of various hypercapnic regimes on urinary and salivary K and Na levels were studied in 28 healthy men, 25-35 years old, to assess human adaptability to extreme environmental condition in terms of water-electrolyte balance. Increasing the CO<sub>2</sub> tension in inhaled air led to elevation of K in saliva. In 2-7% CO<sub>2</sub>, the increase in K was directly proportional to the level of P<sub>O<sub>2</sub></sub> in the gas mixture. Salivary Na remained at baseline level at normal P<sub>O<sub>2</sub></sub>, but increased in hyperoxia with 1-4% CO<sub>2</sub>. An increase in the Na concentration of saliva in combinations of hypoxia and hypercapnia was evident only when 2% CO<sub>2</sub> was present in the mixture. With an increase of CO<sub>2</sub> to 6% the Na/K ratio in the urine increases. The urinary Na/K value continued to increase as hypercapnia approached 8% CO<sub>2</sub> with concomitant hypoxia; however, in combination with normal P<sub>O<sub>2</sub></sub> and hyperoxia, Na/K ratio declined. Water balance remained normal on breathing air with elevated P<sub>O<sub>2</sub></sub>, but became negative in normal or hypoxic P<sub>O<sub>2</sub></sub>. Water intake was elevated to a statistically significant degree in hypoxic conditions, while excretion was inversely related in a linear manner to the P<sub>O<sub>2</sub></sub>. The water-electrolyte homeostatic system was thus seen to be responsive to environmental changes in inhaled respiratory gases. Figures 4; references 20: 14 Russian, 6 Western.

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## PROTECTION FROM STRESS

Moscow KHIMIYA I ZHIZN in Russian No 7, Jul 86 pp 28-32

[Article by A.L. Rylov, candidate of medical sciences]

[Abstract] A review is presented in popular vein of the various brain peptides and other factors involved in mediation and protection from emotional stress. Among the chemicals that receive primary attention are the endogenous opiates. These molecules are short peptides that have been found to alleviate pain by acting on the same receptors as does exogenous morphine. In the latter category, the most important peptide has been identified as met-enkephalin. Animals with low endogenous levels of met-enkephalin are particularly susceptible to the adverse effects of stress, while those with normal or above-average levels tolerate stress much better. Similar effects have been attributed to the minute quantities of ethanol synthesized in body (but these salutary effects are not to be attributed to the intake of exogenous alcohol). Another peptide that has been implicated in protection against stress has been the 'sleep' peptide (isolated by Swiss workers) although its mechanism of action with respect to stress remains an enigma. Another brain peptide was isolated by British scientists in 1931 and termed the P substances (P for powder). Although in many respects it functions like a classical neurotransmitter, it has been shown to be a potent analgesic and a hypotensive. In that sense, it may also function as an antistress factor. Although all of these and other chemical factors alleviate stress, the final outcome appears to be predicated on mental or volitional ability to overcome adversity.

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UDC 613.6:616.45-001.1/.3

## INDIVIDUAL FUNCTIONAL TYPOLOGY OF SYMPATHOADRENAL SYSTEM AS INDICATOR OF PHYSIOLOGICAL STATUS IN ADVERSE ENVIRONMENTS

Moscow FIZIOLOGIYA CHELOVEKA in Russian Vol 11, No 6, Nov-Dec 85 (manuscript received 8 May 84) pp 903-910

[Article by N.A. Neyzhmakova and L.M. Shafran, Odessa Branch, Scientific Research Institute of Water Transport Hygiene, USSR Ministry of Health]

[Abstract] Determinations of urinary levels of catecholamines, dopamine, and other metabolites, as well as cardiovascular studies and psychological tests, were employed in assessing the functional typology of the sympathoadrenal (SA) system in 137 male sailors, 20 to 40 years of age. The studies, conducted in the course of an ocean voyage led to the identification of the following three parameters as having the greatest predictive value: urinary epinephrine levels and epinephrine/dopamine (E/D) and epinephrine/norepinephrine (E/N) ratios. All three parameters had significantly higher values in subjects classified into Group I (11.4%), than in those assigned to Group II (11.0%).

In addition, during routine work and under conditions of extreme stress epinephrine, E/D, and E/N rose much more significantly in Group I than in Group II. Group I was, therefore, judged to possess a much more responsive SA system rendering the physiological reaction to stress more appropriate and efficient. Group II individuals were felt to constitute a cardiovascular risk group under conditions of prolonged occupational and environmental stress. However, Group II subjects also demonstrated greater tolerance of monotony and later onset of physiological fatigue than evident in Group I subjects. In addition, a third cohort was identified as Group III individuals, with an intermediate SA system typology. Adaptive changes in Group III individuals consisted of a transition to Group I-type of physiological status, while fatigue elicited a physiological transition to Group II-type phenomenology. Figures 4; references 26: 24 Russian, 2 Western.

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#### GEOMAGNETIC FIELD EFFECTS ON THROMBOELASTOGRAPHIC INDICATORS IN HEALTHY INDIVIDUALS

Moscow FIZIOLOGIYA CHELOVEKA in Russian Vol 11, No 6, Nov-Dec 85 (manuscript received 11 Jan 84) pp 1035-1036

[Article by K.P. Omarova, Zh.S. Sundetov and K.U. Kasenov, Aktyubinsk Medical Institute]

[Abstract] Thromboelastographic studies were conducted on 190 subjects, 19-25 years of age, to determine the effects of geomagnetic perturbations on blood coagulation. The study, conducted over a 9-month period, demonstrated that such disturbances lead to hypocoagulation. The biochemical reasons for the change in blood coagulability were due to enhanced fibrinolytic activity in combination with prolongation of recalcification and diminished levels of thrombin and fibrinogen, as well as to elevation of endogenous heparin levels. References 7 (Russian).

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## RISK OF HYPERTENSION AND FUNCTIONAL CEREBRAL LATERALITY IN OIL EXPEDITION WORKS IN FAR NORTH

Moscow FIZIOLOGIYA CHELOVEKA in Russian Vol 11, No 6, Nov-Dec 85 (manuscript received 24 FEB 84) pp 923-926

[Article by V.P. Leutin and Ye.I. Nikolayeva, Institute of Physiology, Siberian Department, USSR Academy of Medical Sciences, Novosibirsk]

[Abstract] A study was conducted on cerebral laterality and risk of hypertension in oil workers dispatched for 2 weeks to the northern reaches of the Tyumen Oblast on a regular basis, in comparison with similar parameters on workers (truck drivers) permanently stationed in Novosibirsk. Evaluation of the two cohorts showed that in the former group (306 men, mean age 33.9 years) 10.8% were left-handed, 23.8% were ambidextrous, 21.6% demonstrated mixed-type of functional asymmetry, and 43.8% were right-handed. The corresponding figures for the truck drivers (258 men, mean age 33.6 years) were 5.8%, 7.0%, 35.7%, and 51.6%. In the control group there were no differences between the right- and left-handed individuals in terms of the incidence of hypertension. However, in the oil worker group the incidence of hypertension among the right-handed workers was 3-fold higher than among the left-handed workers and the ambidexters. These differences were ascribed to the fact that such extreme factors of stress as represented by oil exploration in the Far North involve less physiological stress in individuals with less specialized cerebral hemispheres, as represented by left-handed subjects and ambidexters. It is also evident that this was a selection factor accounting for the underrepresentation of right-handed workers in the experimental group. References 28: 26 Russian, 2 Western.

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UDC 612.847:613.67

## HEAT ACCLIMATIZATION UNDER CONTROLLED HYPERTHERMIA

Moscow FIZIOLOGIYA CHELOVEKA in Russian Vol 11, No 6, Nov-Dec 85 (manuscript received 15 Apr 84) pp 952-956

[Article by Yu.A. Ivanov and L.A. Korolev, State Institute of Physical Culture imeni P.F. Lesgaft, Leningrad]

[Abstract] Trials were conducted with controlled hyperthermia to determine the efficacy of such an approach in acclimatization to high temperatures. The studies were conducted with 60 men subjected to body temperatures of 38.5°C in sweatsuits impermeable to water vapor for 40-45 min while performing physical work of moderate intensity. After 4-5 days of daily sessions the capacity for physical work diminished to  $18.2 \pm 1.16\%$  below baseline levels.

After 9-10 days baseline capacity for physical work was recovered under hyperthermic conditions. However, after 14-15 days of acclimatization the capacity for physical work exceeded the baseline capacity by  $30.5 \pm 3.60\%$  ( $P < 0.001$ ). The increased capacity for physical work under hyperthermic conditions was accompanied by a subjective feeling of well-being. Figures 2; tables 1; references 14: 7 Russian, 7 Western.

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# PUBLIC HEALTH

## PUBLIC HEALTH PERSONNEL, FACILITIES AND SERVICES IN USSR, 1960 THROUGH 1985

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 11, Nov 86 p 105

[Excerpt]

### Main Indicators of Development of Public Health (at End of Year, in Thousands)

Indicator	1960	1970	1980	1985
Number of physicians in all specialties	432	668	997	1,170
Number of midlevel medical personnel	1,338	2,123	2,814	3,159
Number of hospital beds	1,739	2,663	3,324	3,608
Number of medical institutions administering outpatient-polyclinical aid to the population	39.3	37.4	36.1	39.1
Number of female consultation clinics, pediatric polyclinics, and outpatient clinics (independent and parts of other institutions)	16.4	21.0	24.3	27.9

### Preventive Screening Examinations and Clinical Observation of Population [Dispensarization] (Millions of Persons)

Indicator	1970	1980	1985
Number of persons encompassed by periodic preventive screening examinations	101.3	112.5	123.2
in percentages for the number of persons undergoing periodic examinations	94.3	95.6	96.0

Number of persons under clinical observation	26.8	45.0	71.6
outpatient-polyclinical aid to the population			

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NUMBERS OF MEDICAL PERSONNEL, FACILITIES AND HOSPITAL BEDS IN SELECTED CITIES  
OF USSR AT END OF 1985

Moscow VESTNIK STATISTIKI in Russian No 11, Nov 86 p 71-72

[Excerpt]

Table 11. Number of Physicians and Midlevel Medical Personnel at End of 1985\*

City	Number of Physicians of All Specialties		Number of Midlevel Medical Personnel	
	Total, Thousands	Per 10,000 Population	Total, Thousands	Per 10,000 Population
Alma-Ata	10.0	92.9	17.2	159.3
Ashkhabad	3.4	94.0	4.5	123.6
Baku	13.5	79.1	23.5	137.5
Vilnyus	4.1	74.8	8.8	159.5
Gorkiy	8.8	62.2	18.4	129.8
Dnepropetrovsk	6.9	58.4	11.7	99.4
Donetsk	7.1	63.6	14.6	131.6
Dushanbe	4.6	80.7	8.3	144.4
Yerevan	8.3	71.7	14.3	122.8
Kazan	6.9	65.8	12.0	113.1
Kiev	20.7	83.5	35.7	143.8
Kishinev	6.2	95.9	11.1	171.5
Kuybyshev	8.2	63.9	17.2	133.4
Leningrad	42.0	85.9	70.5	144.4
Minsk	10.5	68.5	20.3	132.6
Moscow	90.0	104.2	149.0	172.6
Novosibirsk	11.6	81.1	16.7	116.6
Odessa	9.2	80.4	17.0	148.7
Omsk	7.8	68.4	16.9	147.7
Perm	6.9	64.4	11.9	110.8
Riga	7.1	80.8	14.3	162.2
Sverdlovsk	9.0	67.6	16.8	125.7
Tallin	3.4	69.7	6.8	140.9

Tashkent	16.1	78.3	30.3	147.3
Tbilisi	14.3	123.0	18.2	155.9
Ufa	7.2	66.9	12.6	117.0
Frunze	5.3	84.9	9.2	148.6
Kharkov	10.4	66.6	19.0	121.4
Chelyabinsk	6.9	61.6	13.1	116.3

\*including population centers subject to city soviet.

Table 12. Number of Medical Institutions and Number of Hospital Beds at End of 1985\*

City	Number of Medical Institutions Pro- viding Outpatient and Polyclinical Assistance	Number of Hospital Institutions	Number of Hospital Beds	
			Total, Thousands	Per 10,000 in Population
Alma-Ata	90	53	18.1	167.9
Ashkhabad	35	21	6.0	163.3
Baku	216	93	22.0	129.1
Vilnyus	42	21	10.1	183.3
Gorkiy	129	69	21.5	152.1
Dnepropetrovsk	109	43	16.9	143.2
Donetsk	66	49	17.9	160.6
Dushanbe	70	27	7.8	135.2
Yerevan	112	42	12.0	103.3
Kazan	111	56	16.2	153.5
Kiev	194	93	34.4	138.4
Kishinev	81	28	10.2	157.9
Kuybyshev	107	58	17.6	137.2
Leningrad	488	138	58.1	119.0
Minsk	112	34	19.2	125.5
Moscow	941	235	118.9	137.8
Novosibirsk	117	65	20.3	142.1
Odessa	104	43	14.1	123.1
Omsk	92	55	16.9	148.0
Perm	59	45	15.5	144.4
Riga	71	34	14.4	162.8
Sverdlovsk	84	60	21.8	162.5
Tallin	46	23	6.7	138.5
Tashkent	238	91	32.2	156.6
Tbilisi	180	61	16.4	140.9
Ufa	76	40	17.6	163.8
Frunze	62	28	10.5	169.6
Kharkov	118	64	22.3	142.2
Chelyabinsk	73	51	16.9	150.1

\*including population centers subject to city soviet.



All medical institutions conducting outpatient reception (polyclinics, outpatient clinics, dispensaries, polyclinical departments of large hospitals, medical health centers, etc. have been included in the number of medical institutions providing outpatient and polyclinical assistance to the population.

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## MEDICAL INSTRUMENTATION PROBLEMS

Moscow EKONOMICHESKAYA GAZETA in Russian No 2, Jan 87 pp 6-7

[Article by M. Fedorova, chief physician, No 40 Hospital, Moscow]

[Abstract] The problems with medical instrumentation at the No 40 Moscow Hospital are not unique: At least a third of the medical instruments don't work and the rest are of dubious reliability. This litany of distress applies to newly delivered equipment and instruments that is often nonfunctional or frankly defective. In addition, the problem is further exacerbated that such a large institution as the No 40 Hospital doesn't have a single qualified engineer on its staff to service and maintain the instruments, and has to rely on assistance from outside institutions. In ordering medical instruments the situation is one that fully lives up to the old expression that the right hand doesn't know what the left hand is doing. It is evident that a comprehensive effort must be made to rectify this situation and its negative impact on Soviet medical care.

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## PUBLIC OPINION ON HEALTH CARE

Moscow PRAVDA in Russian 25 Dec 86 p 3

[Article by A. Chernyak]

[Abstract] An article critical of the Party Committee of the USSR Ministry of Health appeared in the September 15, 1986, issue of PRAVDA. Subsequently, a response was published from the Party Committee in the December 5 issue, which in turn elicited a response from the readers. The general opinion was that the response of the Party Committee was evasive and that the 'measures taken' consisted merely of disciplinary sanctions. The readers noted the uneven development of Soviet health care wherein little or no attention is given to local conditions, poorly organized health care delivery exists in the rural areas, and shortcomings occur in medical education. Drugs continue to be in short supply and preventive care, including the mass screening program, continues to be in disarray. All of these factors and negative public opinion demonstrate that a serious overhaul of Soviet medicine is called for.

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#### TEST TUBE BABY BORN IN LENINGRAD

Leningrad LENINGRADSKAYA PRAVDA in Russian 5 Dec 86 p 4

[Article by T. Chesanova; photograph by N. Potemkin]

[Abstract] The first test tube baby was recently born in Leningrad to Gennadiy Aleksandrovich Savitskiy and Rada Dmitriyevna Ivanova, the culmination of some 20 years of research at the Institute of Obstetrics and Gynecology of the USSR Academy of Medical Sciences. The program at the Institute is headed by Anatoliy Illarionovich Nikitin, doctor of medical sciences, a specialist in early embryogenesis. To date, some 100 babies have been born worldwide as a result of in vitro fertilization, a fitting testimonial to the progress of medicine.

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#### PERENNIAL DELAYS IN PRODUCTION OF COTTONSEED PROTEIN

Tashkent EKONOMIKA I ZHIZN in Russian No 10, Oct 86 pp 37-39

[Article by L. Shabshay]

[Abstract] Some 12 years ago scientists at the Institute of Chemistry of the Uzbek SSR Academy of Sciences developed a method for the production of cottonseed protein from cottonseed cake. This was a promising development of a supplemental nutritional protein source, and plans were made for the construction of a producing plant. However, years of delay, lack of cooperation, indifference, and inaction have completely sabotaged the early promising efforts. Now the plant is scheduled for the mid-nineties, at best. In the meantime, the USSR is forced to expend its resources in purchasing expensive soybean protein from the USA, whereas, with such a plant in place, the USSR would be exporting cottonseed protein and earning valuable currency.

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#### FUTURE OF HEART TRANSPLANTS

Moscow LITERATURNAYA GAZETA in Russian 26 Nov 86 p 11

[Abstract] On the face of it, Soviet medicine appears to lag behind other countries in heart transplantation. Recently, however, the USSR Ministry of Health has approved four institutions for performing such operations. The first operation was carried out by Professor Shumakov on October 27, 1986, at the Scientific Research Institute of Transplantology. Although the patient

died within 4 days, the first steps have been taken in establishing a Soviet transplantation program. Much controversy has been generated by this operation, with many negative voices. While it is true that a donor system must be perfected and clinical expertise honed, the USSR cannot be allowed to fall behind other countries. In Cuba, for example, 12 heart transplants had been performed thus far this year, and six in Bulgaria. There can be no standstill in medicine, and Soviet medicine is expected to take its rightful place in advancing medical progress.

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## PSYCHOLOGY

### NEW PSYCHOPHYSIOLOGICAL METHODS FOR STRESS REDUCTION

Moscow PRAVDA in Russian 18 Dec 86 p 6

[Article by O. Frantsen]

[Abstract] Autogenic training, first implemented in Daghestan by Kh. Aliyev, has found extensive application in industrial psychology as a method of overcoming fatigue. More recent refinements in the technique include the practice of autosuggestion as a means of achieving relaxation and abnegation of fatigue. Such measures, practiced for a few minutes, have had a very beneficial effect on work efficiency. Techniques such as these, relying as they do on psychophysiological control mechanisms, appear to open up new reserves in the human potential for overcoming the fatigue that comes from monotony and repetitive situations.

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STATISTICAL ASPECTS OF RELATIONSHIP BETWEEN RADIOPROTECTIVE ACTION OF  
MERCAPTOETHYLAMINE DERIVATIVES AND ANALOGS AND THEIR ELECTRON PARAMETERS

Moscow RADIOBIOLOGIYA in Russian Vol 25, No 3, May-Jun 85 (manuscript  
received 18 Jun 84) pp 422-426

[Article by V. K. Mukhomorov, Military Medical Academy imeni S. M. Kirov,  
Leningrad]

[Text] The study of the molecular mechanisms underlying the action of radiation injury modifiers is of fundamental importance to an understanding of the actuating effects of radiation and the mechanisms of radiation protection. At the same time, the interpretation of the molecular mechanisms of radiation effects opens up future new approaches to finding efficient radioprotective agents. The present work is concerned with a statistical correlation between changes in the electron structure parameters of mercaptoethylamine derivatives and its analogs by altering substituents and their positions, and the radioprotective action of these substances.

In order for a preparation to manifest protective properties, it is apparently essential that it interact with certain active centers of a biosubstrate by intervening in biochemical processes and rearranging many physiological systems of an organism so that its radioresistance will be increased, or interact with the biologically important macromolecules that have been damaged by radiation. Injury to macromolecules is of a complex nature that entails ionization accompanied by a number of rapidly occurring processes that include charge and energy migration of secondary electromagnetic irradiation, ionization, charge localization, polarization of the medium, etc. [1]. The repair of this kind of injury requires that the compound come into contact with the injured macromolecule, and that there also be available charge and energy migration paths between them.

The electron characteristics of substituted aminothiols and their analogs were computed by the semiempirical Hartree-Fock approximation MINDO/3 including the optimization of molecular spatial configuration [2]. As the analysis has shown, the boundary single-electron energies -- the highest occupied level ( $\epsilon_{ho}$ ), the lowest free level ( $\epsilon_{lf}$ ), and molecular orbitals as well as energy differences  $\Delta\epsilon = \epsilon_{ho} - \epsilon_{lf}$  turned out to be the most informative of all the electron parameters that confirm a parallelism with radioprotective efficiency. The Table presents energy levels and survival rates for  $\gamma$ -irradiated mice at a near absolutely lethal dose level

[3, 4]. Inasmuch as the methods employed for evaluating the effectiveness of preparations depend on a multiple of factors which cannot always be precisely accounted for, we found it convenient to divide all of the compounds presented in the Table into three tentative groups with respect to their radioprotective efficiency: Highly active (the proportion of survived irradiated animals for a given time interval  $P=1$ , where  $P$  is the percent of survived animals/100%), average ( $P \approx 0.5$ ), and inactive compounds ( $P \approx 0$ ). In the Table these groups of compounds are separated by a broken horizontal line. This kind of compound separation may be viewed as qualitative and allows us to use statistical methods at the first stage of our study that can establish the conjunction between criteria and qualitative variations.

In employing the indicated tables, we shall divide all the compounds by parameter  $\Delta_e$  into three groups: Group I --  $\Delta_e < 7.9$  eV, II --  $7.9 \leq \Delta_e \leq 8.5$  eV, and III --  $\Delta_e > 8.5$  eV. By statistically comparing the qualitative criteria of [5] we find the conjugate coefficient between the criteria  $\Delta_e$  and  $P$ :  $C_1 = 0.87$ . To test our hypothesis about a connection between the criteria, we apply the criterion  $\chi^2$ . A comparison of the value  $\chi^2$  to the tabular distribution at a 95% reliability level and to a corresponding number of degrees of freedom, leads to the inequality  $\chi^2 = 38.8 > \chi^2_{4;0.05} = 9.5$ . This inequality confirms the existence of a strong stochastic connection between parameter  $\Delta_e$  of the low molecular weight compounds and their radioprotective properties. A supplemental correlative analysis showed that the experimental data can be satisfactorily described by the following functional relationship:

$$P_1 = 0.5 - 6.79 \cdot 10^{-3} \arctg(1.14 \Delta_e - 9.1) \quad (1)$$

The parameters of equation (1) were found by the least squares method. The significance of the partial correlation coefficient  $R_1 = 0.88$  at a 95% reliability level was determined by the inequality  $F = 116.5 > F_{1,43;0.05} = 4.07$ . The fact that the limiting value of Fischer's criterion is exceeded, confirms the high statistical significance of the correlation coefficient.

The magnitude of parameter  $\Delta_e$  of the low molecular weight compounds that lies in the 7.9 -- 8.5 eV energy level interval can be compared to the threshold deactivation processes of the biomacromolecular metastable states that are associated both with the interception of migrating electron excitation within the biosystem and the prevention of potential electron-conformational transfers. From experiments [6, 7] on the radioprotective effect of cysteamine on mammalian cells, it is known that the protector molecules penetrate the cells rapidly and reach the nuclear DNA without any transport-associated difficulties. The low molecular weight compounds, while temporarily interacting with DNA [8], stabilize DNA structure thereby facilitating the dissipation of the electron excitation energy into the conformational energy of the admixture's nuclear subsystem.

Table 1. Electron Parameters and Radioprotective Efficiency (P) of Substituted Amino Thiols and Their Analogs

№	(I) Соединения	$-\varepsilon_{\text{вз}}$	$\eta_{\text{ис}}$	$\Delta n$	$P_{\text{эксп}}$	$P_1$	$P_2$
		$\approx B$			[3, 4]		
1	$\text{NH}_2(\text{NH}-)\text{CNHCH}_2\text{CH}_2\text{SPO}_3\text{H}_2$	9,43	-4,70	4,73	1	0,98	1
2	$\text{NH}_2\text{CH}_2\text{CH}_2\text{SC}(\text{NH})\text{NH}_2$	7,63	0,19	7,82	1	0,57	0,90
3	$\text{NH}_2\text{C}(=\text{NH})\text{CH}_2\text{SH}$	8,25	-1,19	7,06	1	0,82	0,93
4	$\text{NH}_2(\text{NH}-)\text{CNHCH}_2\text{CH}_2\text{SH}$	7,53	-0,27	7,26	1	0,77	0,95
5	$\text{NH}_2\text{CH}_2\text{CH}_2\text{SPO}_3\text{H}_2$	9,57	-4,68	4,89	1	1	1
6	$\text{NH}_2\text{CH}_2\text{CH}_2\text{SSO}_3\text{H}$	9,25	-2,94	6,31	1	0,92	0,99
7	$(\text{CH}_3)_2\text{N}(\text{NH}-)\text{CCH}_2\text{SH}$	7,87	-0,02	7,85	1	0,56	0,89
8	$\text{NH}_2\text{C}(=\text{NH})\text{CH}_2\text{CH}_2\text{SH}$	7,87	-0,03	7,84	1	0,56	0,89
9	$\text{NH}_2\text{C}(=\text{NH})\text{CH}_2\text{SSO}_3\text{H}$	8,52	-3,00	5,52	1	0,98	1
10	$\text{NH}_2\text{C}(=\text{NH})\text{CH}_2\text{SPO}_3\text{H}_2$	8,66	-4,57	4,08	1	1	1
11	$\text{NH}_2\text{CH}_2\text{CH}_2\text{SC}(\text{S})\text{SH}$	8,63	-1,59	7,04	1	0,82	0,90
12	$\text{NH}_2\text{C}(=\text{NH})\text{CH}_2\text{SSCH}_2\text{C}(=\text{NH})\text{NH}_2$	7,78	-1,22	6,56	1	0,90	1
13	$\text{CH}_3\text{C}(\text{NH}_2)\text{HCH}_2\text{SH}$	7,38	-0,21	7,18	0,7	0,79	0,97
14	$\text{NH}_2\text{CH}_2\text{CH}_2\text{SC}$	8,89	-0,72	8,17	0,5	0,42	0,45
15	$\text{NH}_2\text{CHCOOHCH}_2\text{SH}$	9,27	-1,43	7,84	0,5	0,56	0,46
16	$\text{NH}_2\text{CH}_2\text{CH}_2\text{SC}_6\text{H}_5$	8,38	-0,08	8,30	0,5	0,37	0,58
17	$\text{NH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{SH}$	8,85	0,50	9,35	0,5	0,11	0,10
18	$\text{NH}_2\text{C}(=\text{NH})\text{SCH}_3$	8,81	-0,78	8,03	0,5	0,48	0,55
19	$\text{CH}_3\text{CH}(\text{SH})\text{CH}_2\text{NH}_2$	8,91	0,12	9,03	0,5	0,16	0,14
20	$\text{NH}_2\text{CH}_2\text{CH}_2\text{SH}$	8,32	-0,16	8,16	0,6	0,42	0,67
21	$\text{NH}_2\text{CH}_2\text{CH}_2\text{SC}(=\text{O})\text{CH}_3$	8,88	-0,05	8,84	0,5	0,20	0,38
22	$\text{H}_2\text{C}=\text{CHCH}_2\text{HCH}_2\text{CH}_2\text{SH}$	8,61	0,14	8,75	0,5	0,22	0,62
23	$(\text{CH}_3)_2\text{S}=\text{O}$	9,39	-2,12	7,21	0,65	0,78	0,71
24	$\text{CH}_3\text{CH}_2\text{C}(=\text{NH})\text{NH}_2$	8,64	0,33	8,97	0,5	0,17	0,20
25	$\text{NH}_2\text{CH}_2\text{CH}_2\text{SCH}_3$	8,89	-0,06	8,83	0,3	0,20	0,20
26	$\text{NH}_2\text{CH}_2\text{CH}_2\text{SCH}_2\text{CH}_3$	8,90	-0,16	8,73	0,2	0,18	0,13
27	$\text{NH}_2\text{CH}_2\text{CHCOOHSH}$	9,29	-0,75	8,54	0,1	0,28	0,18
28	$\text{NH}_2\text{CH}_2\text{CH}_2\text{SCH}_2\text{SCH}=\text{CH}_2$	8,89	-0,07	8,82	0	0,21	0,25
29	$\text{NH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{SH}$	8,85	0,45	9,30	0,1	0,12	0,11
30	$\text{OHCH}_2\text{CH}_2\text{SH}$	9,80	-0,08	9,72	0	0,07	0
31	$(\text{CH}_3)_2\text{NCH}_2\text{CH}_2\text{SH}$	8,28	-0,01	8,27	0,1	0,38	0,47
32	$\text{NH}_2\text{CH}_2\text{C}(\text{CH}_3)\text{SH}$	8,88	0,06	8,94	0,1	0,18	0,17
33	$\text{NH}_2\text{C}(=\text{O})\text{NHCH}_2\text{CH}_2\text{SH}$	9,40	-0,08	9,32	0,25	0,12	0,10
34	$\text{NH}_2\text{CH}_2\text{CH}_2\text{OH}$	8,98	1,72	10,7	0	0	0
35	$\text{CH}_3\text{CH}_2\text{CH}_2\text{SH}$	9,44	0,42	9,85	0,1	0,10	0
36	$\text{CH}_3\text{NHCH}_2\text{CH}_2\text{SH}$	8,55	0,12	8,67	0,1	0,24	0,33
37	$\text{NH}_2\text{COCH}_2\text{SH}$	9,85	-0,41	9,43	0,1	0,1	0
38	$\text{NH}_2\text{CH}_2\text{COSH}$	9,37	0,09	9,45	0	0,1	0
39	$\text{NH}_2\text{COCH}_2\text{CH}_2\text{SH}$	9,55	0,04	9,59	0	0	0
40	$\text{NH}_2\text{OCH}_2\text{CH}_2\text{SH}$	8,39	0,06	8,45	0,1	0,31	0,53
41	$\text{OHCH}_2\text{CH}_2\text{SC}(=\text{NH})\text{NH}_2$	8,74	0,17	8,91	0	0,18	0,07
42	$\text{NH}_2\text{CH}_2\text{CH}_2\text{COSH}$	9,02	0,46	9,48	0	0,10	0,20
43	$\text{NH}_2\text{COCH}_2\text{CH}_2\text{SC}(=\text{NH})\text{NH}_2$	8,89	-0,01	8,88	0	0,18	0,18
44	$\text{NH}_2\text{CH}_2\text{CH}(\text{OH})\text{CH}_3$	8,95	1,78	10,7	0	0	0
45	$\text{NH}_2\text{CH}_2\text{CH}(\text{Cl})\text{CH}_3$	8,88	0,99	9,86	0	0	0



Key: 1) Compound  
2)  $P_{exp}$

If parameter  $\Delta\epsilon$  markedly exceeds the 7.9 -- 8.5 eV energy level interval, the aminothiols are, as a rule, only slightly active as radiation protectors. When  $\Delta\epsilon < 7.9$  eV, i.e., when it is below the threshold value, practically all of the aminothiols exhibit protective action. It is also possible that in such a case there are also processes that are connected with the phenomenon of conformational selection [9].

The dynamic balance between the admixture's bound state and the target biosubstrate and the released state is determined by short-acting gravitational forces of which the most effective are those that are responsible for the formation of complexes with the charge transfer. As was demonstrated in [10], the ability of the homologous series of compounds to form complexes is primarily determined by the acceptor's energy parameters  $\epsilon_{1f}$ .

By conditionally grouping the preparations by parameter  $\epsilon_{1f}$  into compounds prone to complex formation ( $\epsilon_{1f} < 0$ ) and those that are not ( $\epsilon_{1f} > 0$ ), we can find the statistical characteristics of the connection between the radioprotective properties of the preparations and their ability to form complexes with a charge transfer  $C_3 = 0.54$ ,  $\chi^2 = 7.21 > \chi^2_{2;0.05} = 6.0$ . This result confirms the fact that the ability of the examined series of preparations to participate in the formation of complexes with a charge transfer is essential to the manifestation of their protective properties which by the same token temporarily inhibits the biochemical systems.

The electron-donor properties of compounds have been frequently discussed recently [11, 12] from the viewpoint of their radioprotective action. In order to clarify the nature of the connection between protective action and electron-donor activity, we divided the compounds into two groups: Those presumed to have electron-donor activity ( $\epsilon_{ho} < 8.5$  eV) and those which do not ( $\epsilon_{ho} > 8.5$  eV). We obtained the following rather high level of statistical characteristics:  $C_4 = 0.66$ ,  $\chi^2 = 12.7 > \chi^2_{2;0.05} = 6.0$ .

Our qualitative analysis confirmed that the radioprotective efficiency of sulfur-containing compounds simultaneously depends on many factors. Moreover, we found that all of the discussed electron parameters have a certain threshold value which, if exceeded, leads to marked changes in protective activity. This result allows us to take advantage of the factor correlation analysis methods which, by analogy with equation (1), can be described by the following nonlinear regression equation:

$$P_2 = 0.5 - 6.79 \cdot 10^{-3} \arctg(b_0 + b_1 \epsilon_{hc} + b_2 \epsilon_{hc} + b_3 \Delta\epsilon) \quad (2)$$

However, inasmuch as parameter  $\Delta\epsilon$  is linearly related to  $\epsilon_{1f}$  and  $\epsilon_{ho}$ , regression equation (2) can be substituted by the double parameter equation

$$P_3 = 0.5 - 6.79 \cdot 10^{-3} \arctg(b_0 + b_1 \varepsilon_{ls} + b_2 \varepsilon_{if}), n=45, m=2$$

The coefficients  $b_0=19.84$ ,  $b_1=2.35$ , and  $b_2=1.27$  were found by the least squares method. The statistical significance of the  $b_i$  coefficients was determined by their  $t$ -values:  $t(b_1)=6.78$ ;  $t(b_2)=9.06$ . These values at a 95% reliability level and assigned number of degrees of freedom  $f=n-1=42$ , exceed their critical value  $t_{crit}=2.02$ . The significance of the selected correlation coefficient  $R=0.85$  was found by comparing its  $t$ -values to the critical values:  $t=R\sqrt{f/(1-R^2)}=10.5 > t_{crit}$ . A test employing the Fischer's criterion ( $F=55.4 > F_{2,42;0.05}=3.2$ ) confirmed that the regression under examination had been sufficiently defined by the included variables. The calculated  $P_3$  values are given in the Table.

It is easy to see from the data in the Table how the radioprotective efficiency of the compounds changes in relation to the factors in equation (2). For example, we know that a lengthening of the hydrocarbon chain in the molecule  $NH_2(CH_2)_nSH$  ( $n=2, 3, 4$ ) results in lowered radioprotective efficiency. Actually, when  $n=3$  and 4 (preparations Nos 17 and 29), when compared to  $n=2$  (No 20), the former compounds markedly lower their capability of electron-acceptor transfer. There is a simultaneous increase in  $\Delta E$  energy and by the same token a decrease in the magnitude of  $P$ . The substitution of an amine group in compound No 20 by an isoelectron hydroxyl (No 30) or methyl (No 35) or the substitution of a thiol group by a hydroxyl (No 34) alters the factor criteria so as to decrease radioprotective efficiency. There is a significant increase in the energy of conformational rearrangement which is paralleled by a reduction in the compounds' electron acceptor properties. Blockage of the  $SH$  and  $NH_2$  functional groups (Nos 25, 26, 28, 31) disrupts the threshold limits previously established for the energy characteristics which in turn markedly reduces radioprotective efficiency.

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ABSTRACTS OF ARTICLES ON RADIATION BIOLOGY DEPOSITED WITH VINITI

Moscow RADIOBIOLOGIYA in Russian Vol 25, No 3, May-Jun 85 p 429

UDC 577.391

ANTIRADIATION PROTECTION AND THE CONDITION OF MICE AT DISTANT  
POST-IRRADIATION DATES

[Synopsis of article by S. A. Bolshakova, Institute of Biophysics, USSR  
Ministry of Health, Moscow]

[Text] The condition of chemically protected mice subjected to lethal doses of irradiation was studied one year after exposure. Physical endurance (from the fifth to twelfth month) and resistance to hypoxia (1.5 and 9 months after irradiation) of the irradiated protected animals were found to be at the intact control level which corresponded to their age. At the same time the weight gain of these mice was reliably lower than in the non-irradiated animals. VINITI manuscript deposit No 550-85, Jan 21, 1985.

UDC 577.391

MODIFYING EFFECT OF HYPOKINESIA ON THE INTERPHASE DESTRUCTION OF THYMUS  
AND PERIPHERAL BLOOD LYMPHOCYTES IN IRRADIATED RATS

[Synopsis of article by I. P. Chernov, Ryazan Medical Institute imeni I. P. Pavlov]

[Text] Variably oriented fluctuations in the radiosensitivity of peripheral blood and thymus lymphocytes were detected in experiments on male rats irradiated at doses of 0.2, 0.4, and 0.8 gram-roentgens at critical periods of hypokinesia. Radiosensitivity was found to increase during periods of acute stress and deadaptation phenomena (at 1 -- 3rd and 85th days of hypokinesia respectively) and decrease during a period of relative adaptation (on the 20th day of hypokinesia). The observed fluctuations in lymphocyte radiosensitivity are related to changes in the body's nonspecific resistance and lymphoid tissue during the onset of the hypokinetic syndrome. VINITI manuscript deposit No 551-85, Jan 21, 1985.

CHANGES IN CERTAIN BIOCHEMICAL INDICES IN RAT THYMUS GLAND AT LATE DATES  
FOLLOWING COMBINED EXTERNAL PLUTONIUM-239 AND  $\gamma$ -IRRADIATION

[Synopsis of article by N. I. Yelkina, Institute of Biophysics, USSR  
Ministry of Health, Moscow]

[Text] The number of karyocytes, DNA and RNA content in rat thymus gland was found to be lower than the control levels at late dates following combined and separate exposure to external  $\gamma$ -irradiation at a dose of 103.2 mKl/kg and plutonium-239 at doses of 18.5 and 9.25 kBk/kg of body weight. The inclusion of the tagged precursor into these biopolymers as computed for the entire organ was also lower than the control. The changes in the examined indices were found to be dependent upon the dose of the administered plutonium when it was combined with external  $\gamma$ -irradiation. VINITI manuscript deposit No 552-85, Jan 21, 1985.

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FREE THYMIDINE LEVELS IN SERUM OF IRRADIATED RATS WITH CELLULAR DEPLETION OF THYMUS AND SPLEEN

Moscow RADIOBIOLOGIYA in Russian Vol 25, No 5, Sep-Oct 85 (manuscript received 6 Feb 85) pp 590-592

[Article by L.Ye. Bryksina, A.V. Konov, V.K. Podgorodnichenko, V.K. Mazurik and A.M. Poverenny, Scientific Research Institute of Medical Radiology, USSR Academy of Medical Sciences, Obninsk; Institute of Biophysics, USSR Ministry of Health, Moscow]

[Abstract] Outbred albino rats were employed in a study designed to assess the value of free serum thymidine levels as an indicator of radiation injury. Gamma irradiation with a 3 Gy whole-body dose elicited depression of thymic and splenic DNA levels to essentially the same degree, as did administration of 3 mg of dexamethasone (15 mg/kg t.i.d.). Irradiation on the third day after the course of dexamethasone resulted in additional, but moderate, reduction in the DNA levels. The highest increase in serum thymidine was obtained 6 h after 3 or 6 Gy irradiation in a dose-related fashion. Animals irradiated with the 3 Gy dose 3 days after dexamethasone responded with serum thymidine levels 6 h after irradiation that were equivalent to those in hormone-untreated irradiated rats. However, animals irradiated with a priming 3 or 6 Gy dose did not respond with elevation of serum thymidine when re-irradiated with a 3 Gy dose 3 days later. These observations indicate that the initial radiation killed off cells responsible for serum elevation of thymidine (and which were unaffected by the glucocorticoid), and that for that reason caution must be exercised in interpreting serum thymidine levels as an indicator of radiation injury. Figures 2; references 7: 6 Russian, 1 Western.

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CSO: 1840/253

## INDUCTION OF RESISTANCE MUTATIONS TO 6-THIOGUANINE IN CHINESE HAMSTER TISSUE CULTURE CELLS BY FAST NEUTRONS

Moscow RADIOBIOLOGIYA in Russian Vol 25, No 5, Sep-Oct 85 (manuscript received 6 Feb 85) pp 607-611

[Article by T.V. Yelisova and T.P. Feoktistova, Institute of Biophysics, USSR Ministry of Health, Moscow]

[Abstract] In view of the radiobiological differences between x-rays and fast neutrons, a comparative study was conducted on the induction of resistance mutations to 6-thioguanine by x-rays and fast neutrons in cultured Chinese hamster B-11-d-ii-FAF-28 cells, clone 431. The study with the fission-spectrum fast neutrons (10-130 cGy; 0.75 MeV) showed high RBE relative to the x-rays, with maximum values (13-16) corresponding to dosage levels eliciting minimal mutagenic and lethal effects. The  $D_0$  values for the neutrons and the x-rays were, respectively, 36 and 200 cGy. Despite the high mutagenic efficiency of the fast neutrons on the basis of mutation frequency per cell per unit dose, the relative mutagenic efficiency did not differ significantly from that for x-rays. The number of mutations per cell per one lethal event for the x-rays was calculated at  $(15.2 \pm 1.6) \times 10^{-5}$ , and for the neutrons at  $(17.9 \pm 1.0) \times 10^{-5}$ . Figures 3; references 21: 5 Russian, 16 Western.

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CSO: 1840/253

## EFFECTS OF IRRADIATION ON REGULATORY FUNCTION OF B LYMPHOCYTES

Moscow RADIOBIOLOGIYA in Russian Vol 25, No 5, Sep-Oct 85 (manuscript received 12 Nov 84) pp 640-644

[Article by I.M. Dozmorov, G.V. Lutsenko, I.S. Nikolayeva and T.B. Rudneva, Institute of Immunology, USSR Ministry of Health, Moscow]

[Abstract] In order to further define the reasons for radiation-mediated attenuation of immune responsiveness in mice, the effects of gamma radiation on suspensions of lymph node B cells was tested in a donor-recipient system. The study employed CBA mice as lymphocyte donors, C57BL/6 mice as bone marrow donors, and (CBA x C57BL/6) $F_1$  hybrids as recipients, with irradiation of the cell suspensions with dosages ranging to 464.4 mCi/kg (0.63 Gy/min). The study demonstrated dose-dependent alterations in the B cells when tested in terms of inactivation of allogeneic hemopoietic stem cells. Within a dose range of 0-464.6 mCi/kg a gradual loss of the suppressor function of the B lymphocytes is seen, to be replaced by a region of helper activity and, eventually, recovery of suppressor activity. Figures 5; references 11: 10 Russian, 1 Western.

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CSO: 1840/253

## EFFECTS OF RADIATION AND RADIOPROTECTORS ON HEMOPOIETIC STEM CELLS

Moscow RADIOBIOLOGIYA in Russian Vol 25, No 5, Sep-Oct 85 (manuscript received 27 Nov 84) pp 650-655

[Article by N.F. Barakina and O.N. Rakhmanina, Institute of Developmental Biology imeni N.K. Koltsov, USSR Academy of Sciences, Moscow]

[Abstract] An analysis was conducted on the colony-forming potential of hemopoietic stem cells following sublethal irradiation, employing female (CBA x C57BL)F<sub>1</sub> mice. The donor mice were subjected to irradiation with 3.5 Gy x-ray dose, and the recipients with a 7.5 Gy dose. Irradiation was seen to affect certain properties of the bone marrow hemopoietic stem cells during the exponential growth phase (108 post-transplantation days). These effects were manifested as an increase in the rate of proliferation, a somewhat shortened population doubling time, and in a larger percentage of cells homing-in into the spleen. Treatment of the donors with radioprotective agents (S-(2-aminoethyl)isothiourrea or 2-amino-5,6-dihydro-4H-1,3-thiazine hydrobromide) 10 min before irradiation improved the 15 days survival figures of the recipients, but otherwise had no effect on the behavior of the irradiated stem cells. The effects of the radioprotectors were, therefore, limited to reducing the effective radiation dose and enlarging the population of the viable stem cells. Figures 1; references 19: 4 Russian, 15 Western.

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## POST-RADIATION RECOVERY OF HEMOPOIESIS IN MICE TREATED WITH CELL-FREE TISSUE COMPONENTS OF CENTRAL ASIAN TORTOISE

Moscow RADIOBIOLOGIYA in Russian Vol 25, No 5, Sep-Oct 85 (manuscript received 5 Dec 84) pp 665-669

[Article by A.A. Turdyev, R.B. Usmanov, D.Kh. Madzhidova and Z. Nigmatov, Institute of Zoology and Parasitology, Uzbek SSR Academy of Sciences, Tashkent]

[Abstract] The high radioresistance of the Central Asian tortoise (*Testudo horsfieldi*) led to the use of tortoise plasma and splenic extract in an attempt to reconstitute the hematopoietic system of lethally gamma-irradiated (8 Gy) outbred albino mice. The 30-day survival rate for untreated mice was 4.2%. Plasma-treated mice had a survival rate of 37.5%, and the splenic extract-treated mice a rate of 71.2%. Bone marrow repopulation was virtually complete 8 days after irradiation and intravenous administration of the splenic extract. These observations were taken to indicate that the tortoise



splenic extract contained factors predisposing surviving mouse stem cells to undergo proliferation with concomitant repopulation of the bone marrow. Figures 1; references 8: 5 Russian, 3 Western.

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CSO: 1840/253

UDC 577.391;547.963.3

#### THERAPEUTIC MECHANISM OF ACTION OF EXOGENOUS DNA IN RADIATION INJURY

Moscow RADIOBIOLOGIYA in Russian Vol 25, No 5, Sep-Oct 85 (manuscript received 27 Nov 84) pp 680-683

[Article by A.M. Kuzin, V.A. Kopylov, A.F. Revin, M.E. Vagabova and T.I. Gikoshvili, Institute of Biological Physics, USSR Academy of Sciences, Pushchino]

[Abstract] Experimental studies were conducted on the binding of quinoid compounds to DNA, in order to test the hypothesis that the therapeutic efficacy of exogenous DNA administered to gamma-irradiated animals is due to its binding of radiation-induced quinoids, thereby protecting endogenous DNA. Paper and Silufol TLC studies demonstrated that sperm herring DNA binds regaktenon [sic], a quinoid radiotoxin isolated from gamma-irradiated (150 Gy) potato tubers. Further confirmation for this as the protective mechanism of action was provided by cellophane-bag dialysis studies. Regaktogen diffused out to inhibit growth of corn shoots and cucumber seeds. Inclusion of the DNA within the bag led to binding, prevented regaktogen diffusion, and allowed growth to proceed in a normal fashion. These observations suggest that one of the mechanisms by which exogenous DNA prolongs survival of irradiated animals involves binding of quinoid radiotoxins, resulting in protection of the genome. Figures 3; references 7 (Russian).

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UDC 577.391;591.48;591.818

#### EFFECTS OF GAMMA-IRRADIATION ON MITOCHONDRIAL MONOAMINE OXIDASE ACTIVITY AND SEROTONIN LEVEL IN RAT BRAIN

Moscow RADIOBIOLOGIYA in Russian Vol 25, No 5, Sep-Oct 85 (manuscript received 9 Jul 84) pp 683-685

[Article by I.V. Savitskiy, V.V. Tsybulskiy and B.A. Grivtsev, Odessa Medical Institute imeni N.I. Pirogov]

[Abstract] In view of the radioprotective function of serotonin, a study was conducted on the effects of lethal gamma-irradiation on the brain levels of

serotonin and the enzyme important in its metabolism--monoamine oxidase. Exposure of Wistar rats to a 30 Gy (1.1 Gy/min) dose resulted in an initial rise in the brain serotonin concentration reaching a maximum value in 3 h ( $0.96 \pm 0.01 \mu\text{g/g}$  vs.  $0.82 \mu\text{g/g}$  control value), followed by a gradual decline to  $0.46 \mu\text{g/g}$  in 48 h. Concomitantly, mitochondrial monoamine oxidase showed a similar rise peaking in 3 h, followed by a decline to sub-baseline values over the following 48 h. The reduction in monoamine oxidase with time was ascribed to changes in the mitochondrial membranes, possibly due to lipid peroxidation. References 12 (Russian).

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UDC 577.391;547.436;436.621;386.86

EFFECTS OF HEPARIN ON DIMINISHING RADIOPROTECTIVE EFFICACY OF CYSTAMINE  
RELATED TO DECREASING INTENSITY OF IRRADIATION

Moscow RADIOBIOLOGIYA in Russian Vol 25, No 5, Sep-Oct 85 (manuscript received 19 Nov 84) pp 685-687

[Article by N.A. Zhukova, S.A. Filippova, A.A. Maksimenko, M.V. Mukhortova, G.F. Palyga and A. Vatsek, Scientific Research Institute of Medical Radiology, USSR Academy of Medical Sciences, Obninsk; Institute of Biophysics, Czechoslovak Academy of Sciences, Brno]

[Abstract] The effectiveness of chemical radioprotectors has been demonstrated to diminish as the intensity of irradiation is decreased. Since heparin has been shown to potentiate the protective effects of cystamine in high-intensity irradiation, the present study was undertaken to assess its effects in low-intensity gamma-irradiation. Studies with (CBA x C57BL/6) $F_1$  mice demonstrated that the efficacy of cystamine--administered i.p. 30 min before irradiation in a dose of 170 mg/kg--decreased as the intensity of irradiation decreased from 0.106 to 0.0025 Gy/sec for a total 9 Gy dose. The respective survival figures were  $90 \pm 10\%$  and  $23 \pm 6\%$  for equivalent time periods, with a 100% death rate for the control animals. Administration of heparin (250 U/kg; i.p.) in combination with cystamine raised the survival figure to 60-70%, depending on the time of its administration (15 min or 1 day prior to irradiation). These observations demonstrated that the radioprotective scope of cystamine may be expanded to low intensity irradiation by its combined use with heparin. Figures 1; references 4 (Russian).

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## RADIOPROTECTIVE EFFECTS OF KONTRIKAL IN MICE

Moscow RADIOBIOLOGIYA in Russian Vol 25, No 5, Sep-Oct 85 (manuscript received 18 Dec 84) pp 704-706

[Article by O.M. Atamanova and K.S. Cherkov, Institute of Biophysics, USSR Ministry of Health, Moscow]

[Abstract] To date, the use of natural protease inhibitors in acute radiation sickness has been neglected due to the availability of synthetic agents. In view of this, therapeutic trials have been conducted with kontrikal, a substance isolated from lungs, in the management of WR and (CBA x C57BL)F<sub>1</sub> mice subjected to 8.16-8.64 Gy gamma-irradiation. Determination of 30 survival figures demonstrated that intraperitoneal kontrikal was effective in a dose range of 30-100 U/mouse in providing survival figures of 18-23% (vs. 95% death rate for control animals). Higher or lower doses outside of this range were ineffective. The presumed mechanism of action of kontrikal, when administered within 5 h of irradiation, involves attenuation of vascular permeability. In view of its limited effectiveness, kontrikal would appear to have more promise in treating radiation sickness if combined with other radioprotective agents. Figures 2; references 16: 1 Polish, 7 Russian, 8 Western.

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CSO: 1840/253

UDC 577.391;599.323.4;615.37

## SHIGELLA ANTIGENS IN EARLY PATHOGENETIC THERAPY OF EXPERIMENTAL ACUTE RADIATION SICKNESS

Moscow RADIOBIOLOGIYA in Russian Vol 25, No 5, Sep-Oct 85 (manuscript received 30 Jul 84) pp 707-710

[Article by Ye.S. Gorbunova, Ye.A. Tyurin, I.B. Isichenko, I.V. Vinogradova and A.A. Ivanova, Institute of Biophysics, USSR Academy of Sciences, Moscow]

[Abstract] In view of the demonstration that bacterial antigens may enhance the survival data for irradiated animals, studies were undertaken to evaluate the effects of *Shigella flexneri*, *Sh. sonnei* and mixed antigens. Hamsters subjected to 7.68 Gy gamma-irradiation showed survival rates of 74.7 to 85.4% when treated with the antigens with 4 h of irradiation, versus a survival figure of 19% for control animals. Best results were obtained with the *Sh. sonnei* antigen when administered per or or subcutaneously. Furthermore, the effective dose range was 12.5 to 62.5 mg/kg, with higher doses providing less protection. Mouse studies demonstrated that the *Shigella* antigens functioned to increase the counts of antibody forming cells, with the mixed *sonnei-flexneri* antigen raising the titer 2.7- to 16-fold in different mouse strains.

The radioprotective effects were attributed to the enhanced antibody response in the irradiated animals which enabled them to offer more resistance to infectious complications. Figures 1; references 9: 7 Russian, 2 Western.

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CSO: 1840/253

UDC 577.391;547.963.3;591.81

#### PERSISTENT DNA DAMAGE AND VIABILITY OF MAMMALIAN CELLS

Moscow RADIOBIOLOGIYA in Russian Vol 25, No 4, Jul-Aug 85 (manuscript received 8 Feb 85) pp 435-443

[Article by V.Ya. Gotlib, N.Ya. Taponaynen and I.I. Pelevina, Institute of Chemical Physics, USSR Academy of Sciences, Moscow]

[Abstract] Studies largely conducted on HeLa and LL cells which relate persistence of DNA damage to diminished viability of mammalian cells are summarized. Following irradiation, the cell cultures were treated with a mixture of AraC and hydroxyurea, agents known to inhibit reparative and replicative synthesis of DNA. The fact that these agents further reduce cell survival ca. 2-fold after 3-5 cell generations pointed to persistence of residual DNA damage. Such data would account for the smaller colonies formed by gamma-irradiated cells (4-6 Gy). The nature of the persistent lesions (or incomplete repair) remains unknown. However, such molecular lesions obviously require a considerable period of time for elimination, on the order of a number of mitotic cycles. Figures 3; references 34: 3 Russian, 31 Western.

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CSO: 1840/251

UDC 577.391;611.36;591.04

#### DYNAMICS OF ENERGY BALANCE, DETOXICATION AND BIOSYNTHESIS OF HEPATOCYTIC MACROMOLECULES IN ACUTE RADIATION INJURY

Moscow RADIOBIOLOGIYA in Russian Vol 25, No 4, Jul-Aug 85 (manuscript received 28 Dec 84) pp 462-468

[Article by V.L. Sharygin, M.A. Avakyan, M.K. Pulatova, O.I. Yefremova, Yu.I. Mitrokhin and I.N. Todorov, Institute of Chemical Physics, USSR Academy of Sciences, Moscow]

[Abstract] An analysis was conducted on the response of the mitochondrial redox system and the synthetic capabilities of the endoplasmic reticulum, as well as the kinetics of macromolecular biosynthesis, in hepatocytes of outbred mature male mice subjected to gamma-irradiation in 6 or 8 Gy whole-body doses.

The ESR and other biochemical determinations demonstrated that the energy balance, detoxication, and macromolecular biosynthesis were significantly affected. The mean survival time after 6 Gy irradiation was 13 days and, after 8 Gy irradiation, 11 days. Within 2 h of irradiation the reducing power of the electron transport chain showed a marked increase, transcription was stimulated, while DNA and protein synthesis was depressed. After 2-3 days the ESR spectrum indicated elevation of flavosemiquinone radicals and of Fe-S centers, in conjunction with an increase in the synthesis of proteins, RNA and DNA. The ESR study also showed an increase in cytochrome P-450, and in  $Mn^{2+}$  and  $Mo^{5+}$  centers. Further progression of the acute radiation injury was accompanied by depression of the ESR intensities of all the paramagnetic centers. Figures 4; references 22: 14 Russian, 8 Western.

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UDC 577.391;575.24

#### GENETIC MONITORING OF X-RAY IRRADIATED DROSOPHILA POPULATIONS TREATED WITH MELANIN: POPULATION DYNAMICS AND DENSITY

Moscow RADIOBIOLOGIYA in Russian Vol 25, No 4, Jul-Aug 85 (manuscript received 1 Nov 83) pp 474-478

[Article by I.B. Mosse, V.K. Savchenko and I.P. Lyakh, Institute of Genetics and Cytology, Belorussian SSR Academy of Sciences, Minsk]

[Abstract] A 4-year study was conducted on *Drosophila melanogaster* to determine the effects of irradiation of each generation with a 0.25 C/kg dose, and the effects of inclusion of melanin in the diet. Monitoring revealed fluctuations in the populations due to irradiation and dietary melanin; however, seasonal variations in population density were lacking. Irradiation reduced the mean population density in each generation by an average of 20% in the 1st to 55th generations; with the mean reduction in population increasing to 30% in the 45th to 55th generations. Inclusion of the anti-mutagen melanin in the diet had no telling effect on the population densities. Figures 2; references 5: 1 Russian, 4 Western.

12172/13046  
CSO: 1840/251

## FORMATION OF TOXIC PEPTIDES IN IRRADIATED RATS AND THEIR BINDING TO SERUM PROTEINS

Moscow RADIOBIOLOGIYA in Russian Vol 25, No 4, Jul-Aug 85 (manuscript received 18 Jul 84) pp 495-499

[Article by V.V. Salomatin, G.P. Yefimenko and R.I. Lifshits, Chelyabinsk State Medical Institute]

[Abstract] To further determine the role of endogenous toxic peptides formed as a result of irradiation in radiation sickness, a study was conducted on the rate of formation of toxic peptides, their toxicity, and binding to serum proteins. Outbred rats subjected to 9 Gy gamma-irradiation showed a 1.5-fold elevation of urinary levels of basic toxic peptides (500-2000 MW) on the second day after irradiation, and a 7-fold increase 5 days after irradiation. Administration of the peptides intraperitoneally to C57Bl mice indicated a 2-fold increase in toxicity on the 2nd postradiation day over the increase in quantity, showing a significant change in composition. The peptides represented systemic increase in proteolytic activity rather than enhancement of biosynthesis, with their excretion reaching a maximum in the terminal stages (100% mortality by day 7). Studies of binding to serum proteins revealed complex formation with macroglobulins, immunoglobulins and especially albumin of unirradiated rats, but lack of binding to serum proteins of irradiated rats. The latter observation may have been due to saturation of the binding sites on the serum proteins by various other metabolites formed in the irradiated animals. These findings point to the need for further studies on peptides formed as a result of radiation exposure to assess their full significance in radiobiology. Figures 1; references 17: 14 Russian, 3 Western.

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## EFFECTS OF LOCAL SKIN IRRADIATION ON HISTOMORPHOMETRIC DYNAMICS

Moscow RADIOBIOLOGIYA in Russian Vol 25, No 4, Jul-Aug 85 (manuscript received 11 Jun 84) pp 500-504

[Article by G.M. Kolchanova, A.N. Liberman and I.E. Bronshteyn, Leningrad Scientific Research Institute of Radiation Hygiene, RSFSR Ministry of Health]

[Abstract] Histomorphometric dynamics were monitored between the 38th and the 150th day after local skin irradiation of outbred female rats. The animals were x-ray irradiated with doses ranging from 2 to 30 Gy, with the collated data demonstrating a direct correlation between the dose, the histomorphometric data, and the time elapsed. The relative rates of recovery

of the epidermis and the dermis were 0.0021 and 0.0037 day<sup>-1</sup>, respectively. However, the dermal thickness remained below the baseline control measurements. Irradiation with doses of 10 Gy or greater led to both marked hypertrophy of the epidermis as well as atrophy of the hair follicles. Atrophy of the hair follicles showed progression with time, leading to continuous loss of follicles. Figures 2; references 13: 10 Russian, 3 Western.

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UDC 577.391;591.81;612.015.33

#### EFFECTS OF DNA REPAIR INHIBITORS ON CELL VIABILITY IN IMMEDIATE TWO GENERATIONS SUBSEQUENT TO IRRADIATION

Moscow RADIOBIOLOGIYA in Russian Vol 25, No 4, Jul-Aug 85 (manuscript received 17 Jan 85) pp 515-517

[Article by N.Ya. Taponaynen and V.Ya. Gotlib, Institute of Chemical Physics, USSR Academy of Sciences, Moscow]

[Abstract] The significance of persistent DNA damage and of repair mechanisms in the survival of irradiated cells was studied on a HeLa S3 cell model, using 6 Gy x-ray exposure and addition of AraC + hydroxyurea at various periods of time subsequent to irradiation. Since AraC and hydroxyurea inhibit DNA repair, their addition to the tissue culture would indicate the role of persistent DNA damage in cell viability. The data showed that addition of AraC and hydroxyurea ( $2.5 \times 10^{-4}$  and  $10^{-3}$  M, respectively) depressed the survival figure in the 0 (irradiated) generation by 20-30% when added during the first 6 h of irradiation due to their interference with DNA repair. Significantly, addition of the inhibitors in generation I (the first after mitosis, with a HeLa S3 generation time of 22-24 h) resulted in a 2-fold reduction in viability. The latter findings demonstrated persistence of DNA damage, which may be presumed to predispose to genomic instability and elevated mutation rates in subsequent generations of irradiated cells. References 5: 1 Russian, 4 Western.

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#### LATE ERYTHRON STATUS IN RATS FOLLOWING ACUTE RADIATION INJURY

Moscow RADIOBIOLOGIYA in Russian Vol 25, No 4, Jul-Aug 85 (manuscript received 10 Jan 85) pp 539-544

[Article by O.A. Perminova, Tomsk State Medical Institute]

[Abstract] Outbred male rats were employed in a study designed to evaluate the status of the erythropoietic system following irradiation with a sublethal

x-ray dose. Over the time period in question, irradiation with a 6 Gy dose was seen to diminish the half-life of erythrocytes in the peripheral blood to  $10.1 \pm 0.46$  days ( $11.7 \pm 0.55$  days in control animals;  $P < 0.05$ ). Other changes included an increase in the mean diameter of the erythrocytes in irradiated rats and in their dry weight over the corresponding values for control animals. Bone marrow studies revealed an increase in the erythroid elements and in the index of erythronormoblasts labeled with  $^3\text{H}$ -thymidine, with a concomitant reduction in their generation times. These changes represented an ongoing compensatory process designed to prevent the development of clinically apparent anemia. Tables 2; references 14 (Russian).

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#### CHANGES IN DNA LEVELS IN Sr-90-DAMAGED RAT ORGANS DURING ONSET OF LATE SEQUELAE

Moscow RADIOBIOLOGIYA in Russian Vol 25, No 4, Jul-Aug 85 (manuscript received 14 May 84) pp 544-547

[Article by L.P. Soroka and V.L. Shvedov, Institute of Biophysics, USSR Ministry of Health, Moscow]

[Abstract] A study was conducted on changes in DNA metabolism in various organs of outbred rats following a single i.p. administration of Sr-90 ( $11.1 \text{ kBq/kg}$ ), to assess and correlate such changes in relation to the onset of late sequelae. Monitoring of the animals for 12 months showed a 2-fold reduction in the life span as a result of Sr-90 injection, with 50-70% developing osteosarcoma and 10-15% presenting with leukemia. Analysis of bone marrow, peripheral blood and the spleen showed marked reduction in DNA levels in most of the animals, but lack of such depression in ca. 10-30% of the rats. In the case of the thymus, depression of DNA levels increased with elapsed time. Interestingly, the incidence of leukemia predominated in animals in which reduction of DNA levels in the tissues and organs tested was not a factor. Evidently, the latter animals retained cells with damaged DNA and, consequently, had a higher chance of neoplastic transformation. Figures 2; references 8 (Russian).

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## MORPHOMETRIC STUDIES ON MAST CELLS IN ACUTE RADIATION INJURY

Moscow RADIOBIOLOGIYA in Russian Vol 25, No 4, Jul-Aug 85 (manuscript received 20 Nov 84) pp 548-551

[Article by A.V. Datsenko and V.V. Shikhodyrov, Institute of Biophysics, USSR Ministry of Health, Moscow]

[Abstract] Male Wistar rats were gamma-irradiated with different doses of radiation to induce bone marrow, intestinal and cerebral models of radiation sickness and to assess the status of mast cells in such clinical situations. The extensive morphometric data were analyzed in terms of a computer-derived integral index, based on degranulation parameters. Irradiation of the animals with doses of 6-30 Gy (inducing bone marrow and intestinal models) led to an unalterable downward course of mast cell survival. Irradiation with a 300 Gy gamma dose, sufficient to induce the cerebral model, led to rapid deterioration in the mast cell status within 10 h of irradiation. However, immediately before death the viability of mast cells showed an upturn, a phenomenon that was not encountered with the other models of radiation sickness. Degranulation of mast cells was, therefore, indicative of diminished viability which followed a different course depending on the type and duration of radiation injury. Figures 1; references 10: 7 Russian, 3 Western.

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## MORPHOLOGICAL AND FUNCTIONAL STATUS OF CEREBRAL BLOOD VESSELS AFTER GAMMA-IRRADIATION OF RAT HEAD

Moscow RADIOBIOLOGIYA in Russian Vol 25, No 4, Jul-Aug 85 (manuscript received 13 Jun 84) pp 553-556

[Article by A.N. Kordenko, V.P. Fedorov and I.B. Ushakov]

[Abstract] To expand the number of species on which data are available as to the radiation effects on cerebral blood vessels, female Wistar rats were subjected to 51.6-645 mCi/kg gamma-irradiation of the head for histochemical evaluation of the vascular wall over the subsequent 300 min. Morphological studies failed to reveal any changes within the parameters of the study, although the greater doses of gamma radiation induced some degree of vasodilation in the capillaries. In all cases alkaline phosphatase activity of the endothelium increased to a peak value at 5 h, declining thereafter to baseline levels. Evaluation of tissue mast cells showed degranulation and presumed secretion of indolyl amines, with retention of constant cell numbers. These changes were interpreted to represent compensatory changes, even at the highest doses of irradiation. Figures 2; references 15: 9 Russian, 6 Western.

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EFFECTS OF HELIUM-NEON LASER ON RADIOSENSITIVITY OF ESCHERICHIA COLI K-12

Moscow RADIOBIOLOGIYA in Russian Vol 25, No 4, Jul-Aug 85 (manuscript received 18 Jul 84) pp 557-560

[Article by K.Sh. Voskanyan, N.V. Simonyan, Ts.M. Avakyan and A.G. Arutyunyan, Yerevan Physics Institute, State Committee for Atomic Energy; Scientific Research Institute of Condensed Media Physics, Yerevan State University]

[Abstract] The demonstration that low-intensity helium-neon laser radiation may reduce the incidence of chromosomal aberration induced by powerful laser or ionizing radiation, led to a study on its effect on radiosensitivity of *E. coli* to x-rays. Wild-type *E. coli* K-12 and a super-resistant mutant Gam 444 were subjected to laser emission (633 nm, 2 mW) either before or after x-irradiation within a 40 sec time frame. Laser irradiation alone for 10-15 min had no effect on viability of either strain, whereas 60 min irradiation reduced the viability of the wild cells to 62%, and of the Gam 444 cells to 80%. Laser radiation after x-rays was somewhat more effective in protecting the cells, with an optimal laser irradiation time of 30 sec. Furthermore, the radioprotective effects of low-intensity helium-neon laser were more pronounced in the case of Gam 444 cells than the wild-type cells. The effects of laser irradiation were attributed to enhancement of DNA repair mechanisms, mechanisms which obviously differed with the geno-type of the target cell. Figures 3; references 8 (Russian).

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## CONFERENCES

### CONFERENCE ON ALCOHOLISM

Moscow TRUD in Russian 3 Dec 86 p 4

[Article by V. Belitskiy and D. Struzhentsov, TRUD correspondents]

[Abstract] A recent international conference in Leningrad on alcoholism and discussions with several of the participants have underscored the recent trend of viewing alcoholism as more than just a medical problem. While it is generally accepted that social problems often lead to alcoholism, current investigations have also shown that society can be an important factor in preventing and treating alcoholism. In that respect, psychotherapy has acquired new importance as an approach that uncovers those social conditions leading to alcoholism, provides coping strategies, and delineates avoidance methods. As never before, the comprehensive management of alcoholic cases by internists, psychiatrists and sociologists offers a promising prospect for ultimately overcoming this scourge of mankind.

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### ALL-UNION CONFERENCE ON TRANSPORT ATPases

Moscow BIOKHIMIYA in Russian Vol 51, No 2, Feb 86 pp 345-347

[Article by I.A. Svinukhova and A.A. Boldyrev]

[Abstract] The 11th All-Union Conference on Transport ATPases was held on May 28-30, 1985, in Tashkent, hosted by the Institute of Biochemistry of the Uzbek SSR Academy of Sciences and the Tashkent State University imeni V.I. Lenin. The conference was attended by over 100 scientists from across the USSR and summarized recent advances and prospects in transport ATPase research. Among the papers presented at the conference were recent results obtained in using various toxins as ATPase inhibitors, immunochemical localization of ion channels and ATPases, endogenous inhibitors, and the functions of specific ionic pumps. The papers were supplemented by poster sessions, and the conference ended with the general conclusion that there is

need for more active implementation of computer-based data processing in this area of biochemical research.

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WORKING CONFERENCE: INTERHEMISPHERIC RELATIONSHIPS AND MEMORY

Leningrad FIZIOLOGICHESKIY ZHURNAL SSSR IMENI I.M. SECHENOVA in Russian  
Vol 71, No 8, Aug 85 (manuscript received 25 Dec 84) pp 1039-1040

[Article by T.P. Khrizman]

[Abstract] A conference concentrating on interhemispheric relationships and memory was held on June 11-13, 1985, in Pushchino, at the Institute of Biological Physics of the USSR Academy of Sciences. The majority of the papers (32) dealt with neurophysiological and psychophysiological studies on interrelationships between the hemispheres and memory in the phylo- and ontogenetic aspects. Another 18 papers concerned themselves with the same subject matter from the viewpoints of clinical psychology and neuromorphology. Finally, a special session was held to cover the problem of cerebral laterality and memory as a theoretical challenge, an approach covered in six papers. The presented data demonstrated a more profound degree of laterality in man as opposed to monkey, and the fact that both left and right hemispheric functions underwent adaptive changes in evolution.

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ODESSA MEETING OF SPECIAL PROBLEMS COMMISSION OF HUMAN PHYSIOLOGY, SCIENTIFIC COUNCIL OF USSR ACADEMY OF SCIENCES AND USSR ACADEMY OF MEDICAL SCIENCES: NEUROPSYCHOLOGICAL BASIS OF NORMAL AND DISEASED BRAIN FUNCTION

Moscow FIZIOLOGIYA CHELOVEKA in Russian Vol 11, No 6, Nov-Dec 85 pp 1037-1038

[Article by T.N. Reznikova]

[Abstract] The title meeting was held on October 24-28, 1984, at the Odessa Medical Institute, and dealt specifically with 'stable artificial functional connections' (SAFC). Currently, three academic chairs at the Odessa Medical Institute are involved in research and practical clinical application of SAFC: Pathologic Physiology headed by R.F. Makulkin, Normal Physiology headed by G.I. Fedorovich, and Traumatology, Orthopedics, and Military-Naval Surgery headed by I.G. Gertsen. Recent developments have shown that the method of formation and activation of SAFC-II should be implemented more widely in the therapeutic programs of various health programs. The procedures of SAFC-II

has been found highly effective in infantile cerebral palsy. The commission approved the research done at the Odessa Medical Institute in the field of SAFC-II, and recommended that a symposium devoted to SAFC-II be held in Odessa in the not to distant future. [Note: The author does not precisely define the SAFC-II methodology, nor the significance of "II."]

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UDC 581.1+543.42:628.926+550.82

EFFECTS OF MINERAL DEPOSITS ON PLANT BIOLUMINESCENCE

Kiev DOKLADY AKADEMII NAUK UKRAINSKOY SSR, SERIYA B: GEOLOGICHESKIYE, KHIMICHESKIYE I BIOLOGICHESKIYE NAUKI in Russian No 10, Oct 86 (manuscript received 26 Mar 86) pp 53-55

[Article by V.P. Ilyin, S.M. Kochubey and Yu.R. Shelyag-Sosonko, Ukrainian SSR Academy of Sciences corresponding member, Institute of Botany and of Plant Physiology, Ukrainian SSR Academy of Sciences, Kiev]

[Abstract] A study was conducted to determine the utility of plants as bioindicators of mineral deposits by an analysis of induced fluorescence in relation to soil mineral levels. Studies conducted in a temperate zone demonstrated that the fluorescence (excited at 365 nm) of needles of young (2-4 years) and old pines was affected by the presence of beryllium and zirconium in the soil. Beryllium had an overall effect of enhancing fluorescence and altering the amplitudes of fluorescence peaks at 440-450 and 540-550 nm, with needles from the younger plants yielding more intense fluorescence in test and control situations. Zirconium diminished fluorescence, with the older plants evidencing greater susceptibility. In studies on plants in an arid zone, soil levels of tungsten enhanced blue-green (440-450 nm) fluorescence in winterfat and 'boyalych' [sic], while depressing red (670-740 nm) fluorescence. High levels of molybdenum had the opposite effect on plant fluorescence, while tin was innocuous. It appears, therefore, that under the proper conditions certain plants may function as indicators of soil mineral levels employing readily accessible fluorescence analysis. Figures 2; references 4 (Russian).

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## BULGARIAN INVESTMENT IN BIOTECHNOLOGY

Moscow PRILOZHENIYE K "EKONOMICHESKOY GAZETE" in Russian No 46, Nov 86 p 4

[Abstract] "Bioinvest-Inzhiniring" (BI) is a Bulgarian organization concerned with the import-export of hard and soft biological technology. This technology transfer encompasses equipment and supplies in biotechnology, food and chemical industry, refrigeration technology, and artificial climate systems. BI has contacts with more than 40 countries in Europe, Latin America, Asia and Africa, and has made special arrangements for technology exchange with the USSR and the other countries of the COMECON. At an exhibition held in Moscow on November 19-28, 1986, the full scope of BI's activities was demonstrated, along with planned expansion in the future.

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